THE

ELECTRICAL REVIEW.

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ELECTRICAL REVIEW.

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THE TYRANNY OF THE POSTMASTER-GENERAL.

NO ONE who has constructed or maintained an overhead electric tramway can have escaped the rod of the Postmaster-General, laid on by the hands of his satellites. The Board of Trade made regulations requiring tramway owners to erect, at their own cost, an expensive and dangerous system of guard wires for the purpose of saving the public from contact with telegraph wires which might break and fall over the live trolley wires. In other words, the tramway owners have to protect the public (as well as they can under the added risks thrust upon them), not only from the breakage of their own wires, but from any wires which happen to be near enough to the trolley wires to fall on them if they should break. No matter if the tramway is the first comer: if telegraph wires are erected afterwards, guard wires must be put up at the cost of the tramway undertaking. And the Post Office officials worry the heart out of the responsible man on the tramway, making him comply not only with the plain Regulations of the Board of Trade, which are bad enough in all conscience, but with all manner of supplementary Regulations newly hatched by, or for, the Postmaster-General himself. So long as precautions are necessary to prevent the tramway during normal or abnormal working from injuriously affecting telegraph wires, however distant they be, it is reasonable enough to require the tramway—the obvious offender in such case—to adopt or pay for the adoption of suitable means for preventing future disturbances of the same nature. Under this head would fall disturbances or faults due to induction or leakage. But, when the unoffending tramway owner is saddled under compulsion with the cost of taking care of wires which are entirely foreign to his system, and are supposed to be constructed of suitable materials, and maintained in proper order by a Government Department, over whose actions the tramway owner has no tittle of control, then it is high time to cry aloud for justice.

The cry went up, years ago, and was heard by the Tyrant, who hardened his heart against the suppliants, and, when they became importunate, bade his menials scourge them with scorpions in place of the whips used aforetime. In less symbolic terms, the Post Office declared that guard wires, hooks, diversions, cablings and all other then known instruments of torture were insufficient to protect his Majesty's telegraphs, and that thenceforth the cost of inserting fuses and heat coils in every telegraph circuit which approached a trolley wire should be borne by the tramway undertaking.

No matter that the Postmaster-General deems it expedient for the safety of his lines to provide fuses and heat coils at his own expense wherever there is no overhead tramway system, he will declare, and will maintain even before an arbitrator, that the existence of the tramway in any

particular place has put him in dread of his wires being too weak to stand the strain, therefore he must adopt the extraordinary precaution of using fuses and heat coils at his instruments in case his wires should fall on to the trolley wire, in spite of the entanglements below, which his ingenuity has provided free of cost to himself.

This fresh piece of tyranny has been resented most strongly by all tramway owners, and strenuous efforts have been made to repudiate the persistent claims of the Post Office for payment of its charges for doing routine work in its own buildings. The matter was brought to a head by the recent arbitration proceedings between the Postmaster-General and the Tramways and Light Railways Association. For this purpose a test case was made out of a claim upon the Wemyss Tramway Co., but it was agreed that the decision of the arbitrator should apply generally to some 60 or 70 tramways in the kingdom. In reality, therefore, this was a momentous and final arbitration upon a question of principle.

As reported already in our columns, the award was entirely favourable to the Postmaster-General, but we must confess that Sir Robert Hunter's case seemed slight beside that presented by Mr. Sidney Morse for the Association, although it goes without saying that the handling of the case for the Post Office could not have been more brilliant.

If anyone is interested enough to read, and digest if he can, the legal arguments which are alleged to have led to this decision, he will find a *verbatim* report in the September issue of the Tramways and Light Railways Association Official Circular.

It is not considered sportsmanlike for a batsman to revile the umpire for giving him "out" l.b.w., and, on the same grounds, we will refrain from criticising the arbitrator's award. But it is necessary to point out that all owners of overhead trolley systems are liable now without question to be mulcted in any sum for any work which the Postmaster-General likes to say is a reasonable protection against the trolley wires. That is how the effect of the award presents itself to us, and it is, therefore, an award which makes the tyranny of the Postmaster-General a more relentless instrument of oppression than ever.

The German Electrical Industry.

The favourable results obtained by the leading German manufacturing firms during the year 1908—9 have not, as can easily be imagined, been achieved solely from the trade in the domestic market. Indeed, the inland sales would not have sufficed to guarantee the works that amount of employment which was necessary to yield a satisfactory return on the large capital invested in the undertakings, and the deciding point is declared to have been the circumstance that the companies succeeded in conquering the markets of the world in an increasing measure. Most of the countries in Europe no longer form a specially favourable market for the German firms, as the high Protectionist movement has closed a number of countries to them, whilst others which are still good customers, such as Scandinavia, Belgium, &c., will shortly, it is thought, be gradually lost in consequence of the erection of new Customs barriers. On the other hand, the new United States Customs tariff has not had any material effect on the German electrical industry, as the former does not come into consideration for the latter, owing to the high development of the American electrical industry. But the recent improvement in business in the United States has reacted favourably upon the course of trade of the German works, in so far that the Americans are finding enough work at home, and are no longer so dependent upon competing in the markets of the world. The low prices of raw materials, such as copper, zinc, &c., in recent years, have also been of advantage, and the cheaper supplies of fuel are likewise benefiting the industry. As to the question of railway working by electricity, the work in connection with main lines does not seem to make the desired progress, and the hopes entertained in this respect from the Federal States have again been dissipated. The branches which are expected to offer the largest scope for the employment of electricity in the near future are considered to be electrochemistry and electrometallurgy. In particular it is thought that where suitable ores and water-powers are available, the electrical production of iron will gradually supersede the use of blast furnaces, whilst the progress made in the lamp industry is calculated to lead to the expulsion of gas as an illuminant within a moderate period, and to its employment as a producer of heat to a far greater extent than at present. Apart from these considerations the German electrical firms, especially the A.E.G., are preparing to render themselves more than ever independent of making any purchases in the market other than those of raw materials, and the A.E.G. is negotiating for a larger site in the suburbs of Berlin for the establishment of large works for the production of various articles, including glass and porcelain ware.

Indian Railway Workshops and Electricity.

The various railway workshops are being gradually converted to electric motor drive, and the undoubted economy and flexibility of this method of machine driving so commends itself to the authorities that all-round extensions are in contemplation. The most important railway—the E.I. Railway—has its central shops at Jamalpur, and under the able guidance of Mr. Tyson Wolff, the electrical engineer, a very complete system has been developed. The shops, yards and neighbouring cantonment are brilliantly lighted, and the workshops themselves are quite up-to-date in their modern electric-motor equipment. Between Howrah, the Calcutta E.I. Railway terminus, and Lillooah, the location of the carriage works, there is a three-phase high-tension transmission transformed down at either end for lighting and power.

The O.R. Railway has its central workshops at Lucknow, and here, too, are some very modern examples of motor work. Various sized motors are geared down to direct drive on to slow-speed shaft lines, doing away with the old cumbersome, noisy, and inefficient belt drive from engines fixed at the end of each line of shafting. For the carriage works there is a high-tension three-phase transmission, the voltage at the far end being stepped down for use on small motors for various purposes. The O.R. Railway is wholly a Government Railway, and no electric extensions have been carried out during the current year. It is said that the recently appointed loco. superintendent is hatching a large scheme for electric expansion, which will probably be put into effect in the next financial year if the Budget and the higher authorities are both favourable.

The North-Western Railway has its headquarters at Lahore, where a new workshop is being built. Under the skilful direction of the electrical engineer, Mr. G. Wright, the electrical equipment of the old workshops leaves nothing to be desired. The special feature here is the single motor drive, each machine—lathes, planers, rolls, and drills—being entirely self-contained, with its motor and switchgear under the immediate and easy control of the workman.

The central power station is modern in every respect, the latest addition being several sets of chain-grate mechanical stokers for the water-tube boilers. It is anticipated that the electric installation of the new workshops will be a masterpiece in its way. Being a Government railway, all machinery

is indented through the India Office, Whitehall, and Indian contractors get the go-by, except in cases of emergency, and for casual accessories. This is an old grievance in India, and will probably remain a grievance—but that is by the way.

Bengal-Nagpur railway workshops at Khargpur, about 70 miles from Calcutta, leave little to be desired in the way of up-to-dateness. The electrical engineer, Mr. Franklin, who is at present home on leave, is a keen enthusiast at his work, as is shown by a cursory glance over and around the shops. As the workings of this line are not so completely overshadowed by Government officialdom as those of the other lines, possibly the results are due to greater freedom of design and more scope for originality.

The foregoing by no means exhaust the number of important railway lines with large and modern electric equipments. The Great Indian Peninsular Railway, the Bengal North-Western, the Madras Railway, the South Indian, all can boast of having important electric power plants, but the few superficial notes given will help to indicate that railways in India are not far behind their elder brethren at home in their utilisation of modern electric ideas and practice.

What Can be Registered as a Trade Mark?

Dealers in electrical fittings are often anxious to appropriate for their own use and benefit some special word or phrase, and register it as a trade mark. It is almost a natural tendency for anyone who is selecting a trade mark to endeavour to acquire some title which shall be laudatory of their goods, or attach them to a particular locality. But this the law does not allow.

In giving judgment in three trade mark cases heard in the Court of Appeal, the Master of the Rolls laid down certain principles of general importance in relation to what is, and what is not, a valid trade mark. The real importance of his observations lies in the fact that this is the first time that the Court of Appeal has had to consider the meaning of Sec. 9 of the Trade Marks Act, 1905, which amended the law affecting trade marks. By that section, a trade mark must contain, or consist of, at least one of the certain essential particulars, including the name of a company or form represented in a special or particular manner, a signature, or an invented word or invented words. It may also (by Sub-sec. (4)) consist of "a word or words having no direct reference to the character or quality of the goods and not being according to its ordinary signification a geographical name or surname." No other name, signature, or word can be deemed a distinctive mark, except by order of the Board of Trade or the Court. The object of Sub-sec. (4) is clear. It is meant in the first place to prevent traders seizing hold of laudatory adjectives and monopolising them. For instance, "Elegant electric fittings" could not be registered. In the second place it is intended to prevent the name of a town or district being attached to one article to the exclusion of others. Thus, "Birmingham boosters" could not be registered. As the Master of the Rolls said: "Wealthy traders are habitually eager to enclose part of the great common of the English language, and to exclude the general public of the present day and of the future from access to the enclosure." He also said: "It is apparent that no word can be registered under this Sub-sec. unless it is 'destructive,' that is to say, 'is adapted' to distinguish the goods of the proprietor from the goods of other persons. Some words such as good, best, &c., cannot be adapted. There are other words which are capable of being adapted, and as to such words the tribunal may be guided by evidence as to the extent to which use has rendered the word distinctive. . . . . It is not unimportant to observe that a laudatory epithet if allowed to be registered cannot be removed after seven years. . . . . Again, there is this distinction between word marks and other marks. A word appeals to the eye as well as to the ear. It seems to follow that a word not being an invented word ought not to be put on the register if the spelling is phonetic and resembles in sound a word which, in its proper spelling, could not be put on the register." In the light of these observations the Court declined to allow the registration of the "Crosfield's Perfection Soap" with the word "Perfection" upon it. They also granted an application to remove from the register the word "Orlwoola" as applied to woollen goods. They refused, however, to prevent an application being made for the registration of "Californian Syrup of Figs," because it has here for many years been a widely-known proprietary medicine, and the name has been recognised in litigation as a trade mark. It is material, however, to observe that when the application for the registration of these words is made it will be competent for other persons to come in and object.

We sometimes wonder whether people really understand the distinction between a trade name and a trade mark. A trade name can be acquired by long usage, and if the goods of the particular trader have come to be known by it, it can be protected. Thus, suppose certain goods had come to be known in the electrical world as "Morell's Matchless Motors," no one else could describe his motors as "Morel's Matchless Motors," making a colourable alteration in the spelling of the name for the purpose of deceiving the public. Again, if the firm of Brown & Robinson sold "Brown and Robinson's Lamps," Robinson, who carried on a rival business, could not take a man named Brown into partnership for the express purpose of enabling him to call his lamps "Brown & Robinson's." He could not, of course, be actually prevented from taking Brown into partnership, but the Court would restrain him from selling his lamps under such titles as would be calculated to lead the public to think that they were the goods of another and an older firm.

Tramways and Stray Dogs.

Law is said to be the incarnation of common sense! That is the theory; but a casual perusal of many of the decisions of the Courts is not always calculated to convince the non-legal mind. As a general rule where there is a dispute between a tramway company and a passenger, the company comes off second best. This is nearly always the case where the issues of fact are left to a jury. When the trial is before a judge alone, the element of prejudice is eliminated, and the dictates of common sense appear to mould the decision. In this connection reference may be made to the case of Todd *v.* Paisley District Tramways Co., decided in Scotland on December 7th.

The claim was for £20 damages in respect of the loss of a dog, said to have been killed through the fault of a servant of the defenders. It was alleged that on August 10th, 1909, while acting as driver of a car, notwithstanding the fact that a valuable schipperke dog which belonged to the pursuer was then underneath it, and that his (the driver's) attention was duly called to the fact, he started the car, with the result that the dog was killed. The defender's witnesses stated that the car was in motion when the driver's attention was called to the fact of the dog being under the car, and that immediately he was informed of the fact he stopped his car as quickly as it was possible for him to do so.

Sheriff Lyell, in deciding the case in favour of the defenders, stated that it was unnecessary for him to deal with the evidence of either the witnesses for the pursuer or the witnesses for the defenders, as to whether the car driver stopped his car after his attention had been directed to the dog being under same, as the pursuer himself had so materially contributed towards the accident by permitting what he contended was a very valuable schipperke dog, to be at large and unattended in a public thoroughfare, where there was an obvious danger of its coming to grief, and he accordingly found for the defenders, with costs.

We should be glad to see the principle of contributory negligence more often applied to accident cases on this side of the border. For instance, if those who are in charge of children allow them to run at large in streets and other places where they are in constant danger, why should the owner of the vehicle which runs over the child be always held responsible?

ELECTRICITY IN THE WEAVING SHED.

In view of the extremely unconvincing report on electrical driving of textile factories which was recently issued by the Bradford Engineering Society, it is somewhat of a relief to turn to a careful investigation carried out in connection with a small German jute weaving shed, which possibly did not offer the best of opportunities for electrical driving to prove its worth.

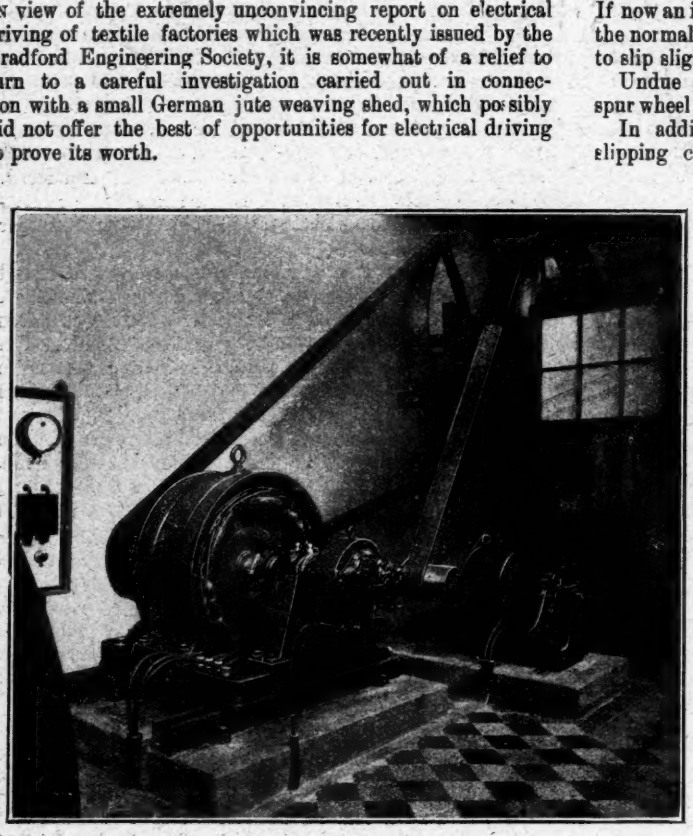


Fig. 1.—Siemens-Schuckert Generators Supplying Power to Weaving Shed.

The weaving shed in question is situated in the town of Vetschau, and the owners were confronted with the question whether they should choose mechanical driving direct from the engine or individual electrical drive, using the same engine for generating electricity.

With a view to arriving at a decision, tests were made of steam and coal consumption with the existing installation, which showed that the 30 looms in use averaged ·52 H.P. per loom, with reed widths of 36 in. to 72 in. and speeds of 130 to 112 picks per min. This power consumption was averaged from several indicator diagrams, giving 15·7 I.H.P. for the 30 looms, but as it was recognised that loom stoppages affected the figure, and that a single loom under normal running conditions required more than ·52 H.P., further tests with three motor-driven looms of different sizes were arranged by the Siemens-Schuckertwerke, which confirmed the experience in other jute mills that the power consumption could be reduced and the output increased, and incidentally led the firm to adopt the individual electrical drive without reference to a possible increase in power consumption.

It was found that the annual coal bill with the existing drive amounted to £28 7s., and the firm agreed that it would pay to install the individual electric drive even if the coal bill increased to £33 17s.

The actual plant installed consisted of an 85 KVA. three-phase alternator giving 230 volts pressure at 750 R.P.M., and a dynamo for lighting purposes giving 210 amperes at 110 volts and 1,280 R.P.M., both being belt-driven from one countershaft, as shown in fig. 1.

The loom drives, which are shown in figs. 2 and 3, necessitated the re-erection of those machines, and include reduction gears and slipping clutches.

The working of the clutch is as follows:—A brake disk B is keyed on the loomshaft A, fig. 2. The large spur wheel C, having the brake lever D fixed upon it, surrounds the disk B. By means of the lever D the brake-band E, which is laid round the brake-disk B, can be drawn as tightly as desired. The tension is obtained from the spring F, which can be regulated by the nut G.

The spring F is thus tightened until the power necessary to drive the loom smoothly is transmitted from the large spur wheel C to the brake disk B, and thus to the loomshaft A. If now an impulse is given in excess of the torque suitable for the normal running of the loom, the brake band E is enabled to slip slightly on the brake disk B.

Undue strain is thus avoided on the teeth of the large spur wheel C and of the pinion H on the motor spindle.

In addition to the occasional overloads mentioned, the slipping clutch comes into action every time the sudden stoppage of the loom takes place in ordinary working. The loom motors are totally enclosed as a protection against dust and mechanical injury.

The interest of the case, however, lies in the results obtained with the new drive, which was tested by several independent investigators on behalf of the firm.

In the first place it was found that the speed of the looms averaged 9·15 per cent. higher than with mechanical driving, and that due to the regular drive yarn breakages were no more frequent and the cloth had a more uniform appearance.

Under the new conditions the average power consumption works out as follows, the results being summarised:—

By the terms of the agreement the original power consumption (15·7 H.P.) could be increased in the ratio $\frac{£33\cdot17}{£28\cdot7}$, giving 18·8 H.P.

Allowing for increased speed (9·15 per cent.) this becomes 20·5 H.P.

Allowing for the "standstill" time, which was with steam drive 40 per cent., and under the new conditions 26·4 per cent., the consumption may be further increased to—

$$20\cdot5 \times \frac{(100 - 26\cdot4)}{100 - 40} = 25\cdot2 \text{ H.P.}$$

It had thus to be proved that the 30 looms with individual electric drive did not require more than 25·2 H.P. on the average, assuming a fully-loaded generator with an efficiency of 87 per cent. and an engine with an efficiency on full load of 85 per cent.

Tests were taken with the 30 looms running only, and nine steam diagrams showed an average of 42·7 I.H.P.

Deducting the friction load of the engine (16·6 H.P.),

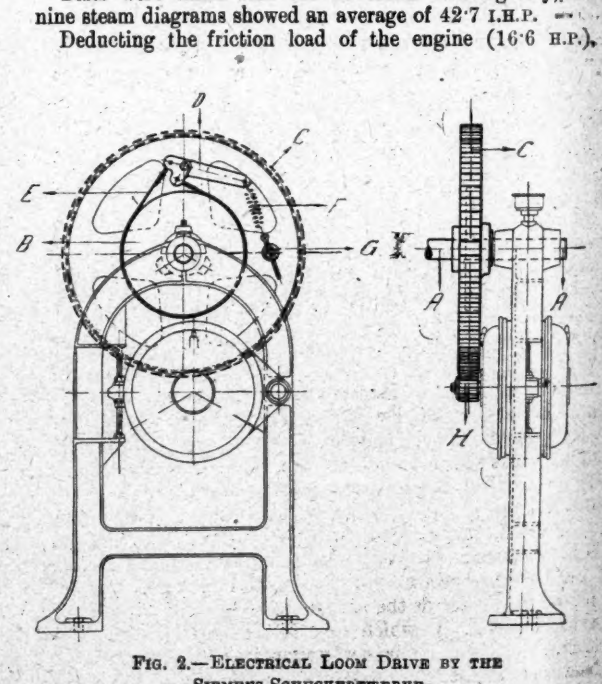


Fig. 2.—Electrical Loom Drive by the Siemens-Schuckertwerke.

and allowing an engine efficiency of 85 per cent., the power consumed amounted to—

$$(42\cdot7 - 16\cdot6) \times \frac{100}{85} = 30\cdot7 \text{ I.H.P.}$$

Making an allowance for the generator working at only 68 per cent. efficiency owing to the small load, the figure is again reduced to 24 H.P., or 4·6 per cent. less than the guaranteed figure.

The most important result, however, is that the same looms as were mechanically driven are now able to give an increased output of 15 to 20 per cent., and that with (as the result of further tests) a decreased coal consumption of 2 lb. of coal per loom per day.

As we have previously mentioned, this particular case—for the details of which we are indebted to Messrs. Siemens Bros. Dynamo Works, Ltd.—is not one which favours the individual electrical drive, but the results show that it is well worth recording.

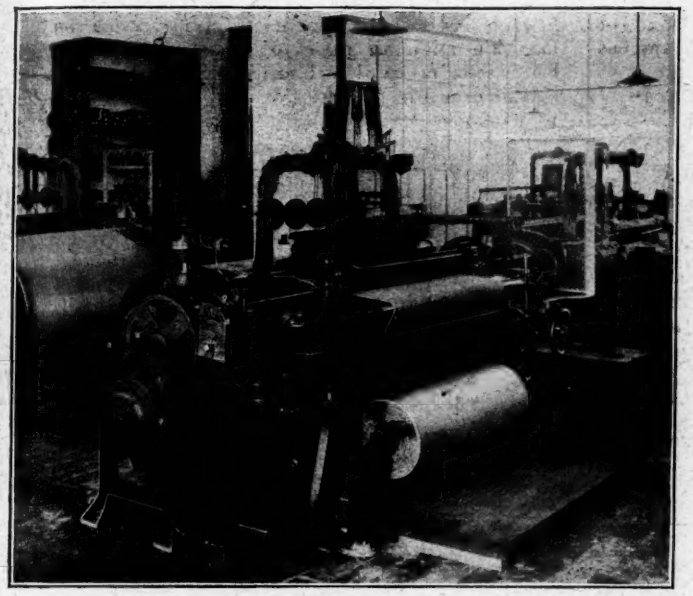


Fig. 3.—Electrically Driven Loom, Siemens-Schuckert System.

We only regret that the German investigators did not carry their tests a little further and provide us with some actual figures as to the net value of the increased output of the looms, and the terms under which the Siemens-Schuckertwerke carried out the installation, as it is an unfortunate fact that the British manufacturer is, generally speaking, unable to grasp the advantage of a change unless it be stated in value of yarn or cloth, and is, moreover, not so favourably placed, financially, as his German contemporary in regard to the carrying out of such a scheme as that referred to above.

IN REPLY TO "A. P. C."—A BROADER PHILOSOPHY.

The strong shall wait for the weary, the hale shall halt for the weak. . . . . With hammer and chisel and pen, We will work . . . . . for ever and ever. Amen.—*Kipling.*

The arguments recently advanced in these columns under the heading, "The Fetish of the Steady Job" (November 19th, 1909, pages 838, 839), can hardly be allowed to pass unchallenged. Already, at least one correspondent has pointed out some of the inaccuracies of reasoning, but there are many still uncorrected. The article referred to cannot be called unbiased, or even reasonable. Its tone is bitter, so bitter, indeed, as to suggest a disappointed desire on the part of its author to secure one of the "steady jobs" which he so much decries. He accuses Government officials of ignorance concerning the conditions of commerce and trade: the accusation is, in the vast majority of cases, unfounded, such men having, and generally utilising, exceptional facilities for studying this subject. The author ventures to express an opinion that "A. P. C.'s" knowledge of Government officials, their work and merits is highly superficial. The philosophy he advances is shallow and none too wholesome. It is, however, one which is too frequently urged in extenuation by those who participate in a "wild and undignified rush" after their own advantage.

The sentiment of "Sufficient unto the day, &c.," is greatly and widely distorted and abused, while, on the other hand, that of Kipling's "Imperial Rescript" is equally contravened. It is difficult to discuss such a topic as the present one without encroaching on the borders of religion and sentiment, but the author thinks that the following remarks will be endorsed by most broad-minded persons, and such as are not too hopelessly prostrated by the gold fever.

"A. P. C." assumes that all men are, by nature, inherently "slackers" (a cynical and rather significant assumption). Without going so far as to inspect "the whole world's history," or to study "the rise and fall of nations," it may be safely asserted that the above conclusion is erroneous. A capable man of the type which "A. P. C." assumes would succeed so brilliantly if only subjected to insecurity of tenure, would rather rise to yet greater heights in consequence of the very knowledge that he worked towards a steady end. His employment would not change with the days and there would be real inducement to concentration.

Rich men, who have, from the present point of view, a maximum "security of tenure," frequently abuse the same and lead idle wasted lives, but it must be admitted that an increasing number follow a brilliant and useful career—and this is especially so in the scientific world. Security of prospects has again and again enabled progress which would have been impossible had £ s. d. alone been the end in view. Life is given to us that we may live, and on "A. P. C.'s" own showing, the steady-job man leads a steady, clean and useful life—one from which revolutionary methods and aims are no doubt excluded, but one which the author ventures to affirm is of more real merit and leads to greater national stability than the strenuous life which "A. P. C." advocates. There is a strenuous life which is meritorious, but it is not that which the condemnation of the "fetish" upholds.

The existence which "A. P. C." apparently regards as ideal is one of *purely selfish* motives, and therein lies the real core of the whole discussion. The perfect submersion of self is vaguely advocated, but is totally at variance with the general sentiment of the article. Moreover, the author fails to see how, self being eliminated, anyone could derive the least pleasure or use from life. The whole community is supposed then to be feverishly working each man for his advancement, yet self is presumed submerged, and the net result anticipated is a race of supermen—the argument is not convincing.

"That specialisation is valueless" is, surely, the grossest and most absolutely unjustifiable statement in the whole of the article or philosophy criticised. Again, America is stated to be the first country to appreciate the futility of specialisation, yet America is to-day the most striking example of ultra-specialisation which the world has yet seen.

Confining our attention to engineering ("A. P. C.'s" sweeping denunciation of "every trade and profession" having no subsequent support in his indictment), American engineering is brilliant, but can scarcely be termed reliable. Refer but to the appalling death roll of colliery and railway accidents, to the continual failure of engineering structures of every kind in the New World, and it will be seen that the fruits of strenuous insecurity may be bitter.

Insecurity in one part of a social scheme must result in insecurity in every other section thereof, particularly where the fundamental insecurity lies in the tenure of position on which depends the livelihood of the community. In America, insecurity of life, property and finance, and even of integrity and honour is only too well known.

E

The author has heard it repeatedly asserted by travellers and residents in America that the average American, with all his hustle, fuss and commotion, does not "get any forrarder" than his more phlegmatic fellows across the seas. Time devoted to the direction of energy expenditure, to a true course for the end in view, is not wasted.

Possibly quite a number of persons will hear with surprise that France is a decadent country—among them is the author. Personally, from a considerable study of the motor and aeronautic industries and from a tolerable acquaintance with recent developments in science, he was under the impression that France was far from losing her high position among nations. The only decadence which France has really to lament is that of her birth rate. This is truly alarming, and would hardly be remedied by the adoption of the principle that "marriage and settling-down are but minor considerations."

The choice of Germany as an example of the benefits of uncertainty of prospects is not at all convincing, seeing that German stolidity, constancy of purpose, and tremendous specialisation and attention to detail, are leading national characteristics.

"Greatness" in the financial world can, of course, hardly come to one in a Government or municipal position, but abstinence from the reckless and ruthless gambling, which unfortunately characterises so many millionaires, is hardly regrettable. It has been wisely said that no man can honestly acquire many millions of pounds in a life-time, and seldom even one million. The success of that one man is purchased with the happiness, honour and, too often, the lives of his rivals or victims.

Turning, however, from commerce to science, it cannot be denied that the sense of security, engendered by the knowledge that one can always obtain a livelihood for himself and those dependent upon him, is far more conducive to earnest endeavour and uninterrupted progress with scientific matters than would be the so-called "strenuous" life. A "great" man is not likely to be repressed by holding a Government position or other "steady job." Surely the knowledge that he has a steady competence on which to rely will embolden him to pursue original lines of study, research and working which he would hardly dare to follow under other circumstances.

"The whole world's history goes to prove that the man with the steady job has never done anything to aid progress, &c.," is again a grave misstatement, though it is difficult to repress a smile at the confident naivete of the wording. Many of our greatest men living at all periods of our history and following many different "trades and professions" have held State or other "steady jobs." The world's great men have ever been characterised by the zeal with which they pursued their avocation for its own sake and their disregard of their own fame and prosperity.

In the Government position, so far as concerns the work directly connected therewith, the individuality of a man is no doubt largely obliterated, but conscientious fulfilment of duty and thoroughness in detail are encouraged. To say, however, that a Government official has no personal responsibility is ridiculous. Every such official—excepting those in the lowest positions, held by men who would otherwise be door porters or hold other posts of similar insecurity of tenure but doubtful national importance—is under a heavy personal bond. He is fully responsible for any error on his part whether in the collection of duties, the sale of stamps or licences, in accountancy or in more abstract inspection duties. Moreover, these bonds are rigorously enforced.

As to whether a rapidly varying occupation is really more interesting than the thorough study of one or a few branches of knowledge there can, of course, be two opinions, but an expert in any subject—and it *is* the experts who nowadays count—will affirm that the more advanced his studies the more interesting have they become to him. The author is still of the opinion that a subject which is made an able man's life work is likely to yield better results than would a medley of matters under the same conductor. On the other hand, an incapable is more likely to approach useful efficiency and reliability by adhering to one avocation than by repeatedly changing his employment. Such men must come into the world, and we are scarcely justified in urging their extermination. As to whether a man has a "right of existence," it is not for a fellow mortal to determine. The licence of life is granted equally to us all: to discuss whether such equality is justified approaches dangerously to arrogance.

Our lives are surely given to us for some better end than mere money-grubbing and killing off our less efficient neighbours. There is a certain genus of beings who prate of the benefits accruing to mankind from the strenuous life as advocated by them. In reality these beings, wittingly or unwittingly, care for nothing but their own advancement: their morals are hopelessly warped by the spell of greed, and to engender a nation of such creatures would be hardly less disastrous than reversion to Anarchy and Socialism.

Safety, reliability and thoroughness are essential in engineering, in individuals and in nations. Transient effects, however brilliant, can have no permanent value, and the long thin trail on the record of time, however faint, will be longer seen, respected and remembered than the misplaced cavities caused by the explosive, ill-directed energy of the modern strenuous man.

Pampered luxury will lead to the downfall of any nation, as surely as it precipitated the Empire of Rome, but the philosophy which sets every man against his neighbour in a mortal fight for that from which, when attained, all pleasure in possession has flown, is no less disastrous in its results.

Such philosophy is shallow and false: it is selfish in its aims and narrow in its conceptions of humanity. Even in the twentieth century we must leave a small space for sentiment, and must allow that the universe was created for another motive than that every man should waste and shorten his life in a feverish attempt to "best" his fellows.

Lest any should condemn these notes as idealistic—they are surely far more materialistic and representative of the bulk of human nature than a doctrine which has as its goal the "abolition of mediocrity," the creation of "a race of supermen," and the "trampling" and "starving out of existence" of inefficients and all those below the average superman standard—hardly a pretty side of human nature and ambitions.

Hard work, and plenty of it, is an excellent, an essential thing, but it is not enough alone: it is neither necessary nor desirable to live simply and solely to work.

The author is not a Socialist—Socialism spells invidious ruin—he does not believe that the abler man should not rise above his fellows; but, on the other hand, he does not believe in the venomous, extremist principles advanced by "A.P.C." In this he trusts and believes the majority of his readers to be with him.—R.E.N.

THE ELECTRIC LIGHTING ACT, 1909.—A LEGAL VIEW OF ITS EFFECT.

This measure, which is now upon the statute book, comes into force on April 1st, 1910. It makes very important changes in the law relating to the supply of electricity.

It is not possible, in the space of a short article, to deal fully with all the various changes which are made by this Act. It is necessary, however, for the benefit of supply companies and consumers who will be affected, to make brief reference to its more salient features. Sec. 1 makes an important change in the law as to the acquirement of land for the purposes of a generating station. Hitherto it has not been competent for an electric lighting company to acquire land otherwise than by an agreement. Now, however, the Board of Trade may, by a provisional order, authorise any undertakers who are already working under statutory powers, to acquire land for a generating station *either within or without their area of supply*. The price payable is to be fixed in accordance with the Lands Clauses Acts, pursuant to which, of course, 10 per cent. must be paid by way of compensation for compulsory purchase.

The only thing to be said about this clause is that it comes rather late in the day. It would be interesting to know how many supply authorities there now are in the country who are likely to avail themselves of the power here conferred.

The beneficial effect of Sec. 1 is largely taken away by Sec. 2, which provides that no undertakers may erect a generating station on land acquired after March 31st, 1909, unless with the consent of the Board of Trade given by provisional order. Such consent can only be given after notice to owners and lessees of land in the neighbourhood. The section does not apply to transforming stations.

Difficulties have arisen in the past owing to the fact that undertakers have not always been able to break up roads, railways and tramways outside the supply area for the purpose of laying mains. In future, however (by order of Sec. 3), the Board of Trade may authorise undertakers to do this, subject, in the case of roads, to the consent of the highway authority affected. If such consent is unreasonably withheld, the Board may dispense with it.

Supply in bulk has never until now formed the subject of legislation in a public Act. Again, even in the private Acts authorising bulk supply, no authority has been conferred to supply outside the area. Sec. 4 of the measure before us provides that the Board of Trade may authorise supply in bulk by provisional order, unless they think the scheme so large as to merit a private Act. The Board may permit undertakers to supply electricity in bulk to any other undertakers upon such terms and subject to such conditions as may be specified *if the supply can be given without breaking up any streets except such as the undertakers giving or the undertakers receiving the supply are authorised to break up.* "Persons affected" by the order may appear and object thereto.

To "supply electricity in bulk" means to supply it (*a*) to any local authority, company or person authorised to distribute electricity to be used for the purposes of distribution; or (*b*) to any local authority authorised by any general or special Act to undertake or contract for the lighting of streets, bridges or public places, to be used for the purposes of lighting streets, &c.

With regard to supply outside the area, the fact that no supply can at present be furnished outside the area has long been a source of trouble and annoyance. Even where premises are on a boundary line, the owners cannot legally get all their supply from one source. By Sec. 5 of the new Act, provision is made for supply to railways, canals and tramways partly outside the area of supply. Such a supply may be furnished (with the consent of the Board of Trade) for the purpose of haulage or traction. Such consent must not be given until persons affected have been given an opportunity of appearing and stating their objections. A provisional order must, however, be obtained for the supply of electricity to any such railway for purposes incidental to the working or lighting of the railway, &c.

Sec. 6 makes provision for supply to other classes of consumers outside the area. If the Board are satisfied that a consumer outside a supply area wants a supply, and the local authority *and* the undertakers consent, the Board may order a supply to be given upon such terms as they think fit. If consent is unreasonably withheld, the Board may proceed as if it had been given.

With regard to compulsory purchase, useful provision is made, by Sec. 7, to meet the difficulties which must arise in the case of the undertaking of a company which is within the district of more than one local authority. Thus a local authority may, with the consent of the company, and subject to conditions approved by the Board of Trade, transfer their right of purchase to any other local authority. In the case of an undertaking authorised after the commencement of the Act, the consent of the company will not be necessary.

As to joint exercise of powers by two local authorities, Sec. 8 provides that the Board of Trade may, with the consent of the Local Government Board, authorise two or more local authorities to exercise the powers conferred on them by the Electric Lighting Acts or any provisional order.

With regard to revision of prices (Sec. 9 provides that) the period in future is to be five years instead of seven years.

The transfer of powers by undertakers is also put under control. Thus (by Sec. 14) undertakers may not divest themselves of the powers, rights or obligations conferred upon them by the Electric Lighting Acts or a provisional order otherwise than under, and in accordance with, a provision contained in a licence, order or special Act.

One of the most important provisions is that relating to supply to premises having a separate supply. A person having such a supply must (by virtue of Sec. 15) agree with the undertakers to pay them such minimum annual sum as will give them a reasonable return on the capital expenditure, and will cover other standing charges incurred by them in order to meet the possible maximum demand for those premises. The sum to be paid is to be determined, in default of agreement, by arbitration.

Another provision affecting consumers is contained in Sec. 17, which provides that 24 hours' notice must be given to undertakers before quitting any premises supplied with electrical energy by the undertakers. In default of such notice, the consumer renders himself liable to pay the amount registered by the meter at the next reading. Again, if payment is in arrear in respect of one set of premises, the undertakers may refuse a supply to other premises of the same consumer (Sec. 18).

To overcome a difficulty which was brought out in a recent case in the courts, agreements for the supply of electricity are in future to be exempt from stamp duty (Sec. 19).

Amongst the remaining provisions contained in the body of the Act, by far the most important is that which relates to private supply companies. It introduces the monopoly principle. We have often pointed out in these columns that, under existing law, statutory undertakers have no monopoly in their district. Anyone may supply electricity to his neighbour if he is so minded. Sec. 23 of the Act, however, provides that "it shall not be lawful for any other local authority, company, or person *to commence* to supply or distribute electricity within the same area (*i.e.*, the area of the undertakers) unless such supply or distribution is authorised by Act of Parliament or provisional order." The section, however, does not "prevent any company or person from affording a supply of electrical energy to any other company or person where the business of the company or person affording the supply is not primarily that of the supply of electrical energy to consumers." It is further provided that the section shall not prevent any company who at the passing of the Act are empowered by their memorandum of association to generate electrical energy from affording a supply to a railway company for purposes incidental to that company's undertaking other than the conveyance of public traffic.

This section must inevitably be fraught with important consequences to many persons who are supplying electricity all over the country. Times and again we have in these columns pointed out that such a business is legal; and when this Act comes into force there will be many companies and firms in existence who are deriving a decent revenue from this source. The words "to commence," however, which are underlined, seem to show that the section will not apply to companies and persons whose business is *in existence* at that date. Anyone who is about to give or receive a supply should take care to complete his arrangements before April 1st, 1910.

A nice question will arise as to what will be the result of a breach of this enactment. No penalty is specified. Other offences against the Electric Lighting Acts are the subject of penalties or may be the cause of revocation of a provisional order. Presumably the local authority or other undertaker affected could apply for and obtain an injunction.

The provisions of the schedule to the Electric Lighting Clauses Act which relate to meters and their certification are modified in certain material respects. Meters must not only be certified but must be fixed and connected with the service lines in some manner approved by the Board of Trade. A meter will not be considered duly certified unless it is accurate within such limits of error as may be allowed by the Board of Trade. An electrical inspector is at present only bound to examine the meter itself. In future he may be required to examine the connections. At present a meter must not be disconnected by a consumer without notice to the supply authority. In future the supply authority must give notice to the consumer before disconnecting the meter.

We hope to deal much more fully with this Act before it comes into operation.

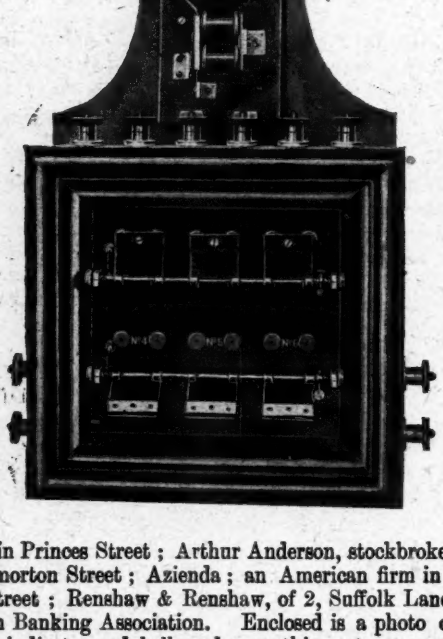
CORRESPONDENCE.

Letters received by us after 5 P.M. on Tuesday cannot appear until the following week. Correspondents should forward their communications at the earliest possible moment. No letter can be published unless we have the writer's name and address in our possession.

The First Telephone Switchboard.

With reference to the correspondence upon the subject of the first telephone switchboard, I beg to bring to your notice one which I believe to be the first, it being prior to either of those mentioned in the correspondence.

A telephone exchange on a small scale was established at 6, Lombard Street, E.C., in September, 1878. The firms connected were :—The Equitable Insurance Co., of New



York, in Princes Street ; Arthur Anderson, stockbroker, 30, Throgmorton Street ; Azienda ; an American firm in Lombard Street ; Renshaw & Renshaw, of 2, Suffolk Lane ; the London Banking Association. Enclosed is a photo of the shutter indicator and bell used upon this system ; upon the fall of a shutter the horizontal rods completed the bell circuit. A common battery was used, and the interruption of the line circuit caused the bell to ring.

F. Higgins.

London, E.C., *December 13th*, 1909.

Protection of Tramway Trolley Standards.

Referring to the letters that have appeared in your columns with respect to the earthing of trolley standards, it appears to be commonly held—amongst rolling stock superintendents, at any rate—that the insertion of a lamp or other resistance to check the current in the event of the standard becoming "alive," is a preventive against electric shock.

The writer is prompted to call attention to this dangerous delusion by a recent experience. Happening to remark casually to a car superintendent that the idea above referred to was a delusion, he was considerably surprised to hear it strongly maintained. The supporting argument is worth recounting, if only to show how dangerous it may be.

On the writer mentioning that the presence of a lamp between trolley standard and earth gave no protection to the passengers, he was met with the statement that "when the lamp lighted up it discharged the trolley standard, so that a shock could not be obtained from it."

Of course, it did not take long to dispel that fallacy, but it is the subsequent query on the part of the superintendent that indicates the real danger ; he said, "Then why do the Board of Trade sanction lamps with audible signals ? "

Of course, I was reduced to silence, because I do not know why the Board of Trade do so, considering that their function is to safeguard the public in every way.

Perhaps you, Sir, can explain why they allow the travelling public to run such unnecessary risks.

Nemo.

[There is only one efficient safeguard that we know of ; and that is to earth the trolley standard with a substantial cable. Why this is not made compulsory we cannot say—it would be easy enough to put an indicator in circuit with the earthing cable, to show which car had earthed the system.—Eds. E R.]

In connection with the discussion going on in your columns at present on the above subject, I would like to draw your attention to a simple method of protection for trolley standards.

A few years ago when trolley retrievers were much discussed, I sketched out an arrangement of trolley catcher which would act as a live trolley indicator.

The method was to provide a spring winch on which the slack trolley rope could be wound. The spring would be normally locked by means of a magnet connected between the overhead line and earth. On the trolley leaving the wire, the magnet would release the spring, permitting the winch to haul down the trolley clear of the overhead work.

If the earth connection of this magnet be made to the trolley standard, then on the standard becoming live, the magnet is shunted by the fault and the spring winch is released, hauling down the trolley. The arrangement would thus constitute a very efficient protection and a very definite indicator.

If it were necessary to get the car home without clearing the earth, means might be provided whereby the spring drum could be mechanically locked ; the same movement putting in action any warning devices that might be thought desirable.

Robert Chalmers Black.

Glasgow, *December 6th*, 1909.

Cost of Living in the Federated Malay States.

I do not agree that the statement mentioned in the Editors' reply in the Electrical Review for October 15th "cuts both ways," because invariably when a man is engaged at home he is taken on at a sterling salary, hence if he has the idea that the dollar is worth only about 2s. he gets a nasty shock, shortly after his arrival, when he learns that instead of receiving, say, $200 per month, he receives actually only $171.40. I can assure anyone intending to come out to the Straits that the difference of $28.60 per month would prove a very considerable amount.

Having met so many young fellows who, soon after their arrival here, have for the first time discovered exactly what their sterling salaries will represent in dollars, I do not think that the point is laboured at all.

It is true that I took exception to the one point only, but I thought that this would make it clear that the writer of the article must have left the Straits some few years ago, and it is generally well known that in a comparatively young and rising colony such as this, great alterations (usually including smaller profits in business and increased cost of living) take place, and it seems to me to be always necessary to get this kind of information direct from one on the spot. Taking one or two items mentioned in the article, the cost at the present time in Singapore would be as follows, according to my own experience :—

Dhobi.—This costs usually $5 per month, although they can be obtained at $4, as against $1.50 mentioned in the article.

Cotton Suits.—It is necessary, on arrival, to purchase at least 15 suits, as the dhobi comes only once a week. He never comes regularly ; this is the usual number to start with : one per day and a spare one = eight, and seven more in the dhobi's hands.

The usual price for these is $45.00 per dozen.

'Rikisha Hire.—In Singapore a European generally uses a first-class (rubber-tired) 'rikisha, the hire for which is 10 cents per mile ; 6 cents, mentioned in the article, is the hire for a second-class 'rik (iron tired). I believe, however,

that in many places in the Native States there are no first-class 'riks.

In the table given of cost of living, no mention is made of 'rik hire, which should be included, as the usual way of getting about is by 'rik, or by the more expensive gharry, of which there are first, second and third class, although, at the present moment, there are, I think, no first-class gharries in Singapore, these having all been labelled second class, and the original second class are now third class.

The very lowest amount spent monthly on 'rik hire is, say, $10.00, and it is generally much more, $20.00 being a safer amount to allow.

There are also other necessary expenses, such as clubs and the drinks thereat; in Singapore, a European must join one club, and he would probably be a member of at least two; most people are. These are the S.C.C. (the Singapore Cricket Club) and the Swimming Club. There are also others.

Precision.

Domestic Electrification.

As the manager of an electric supply company, the writer is deeply interested in cheaper house wiring consistent with good work that will not give trouble, so does not favour flexible wires on walls, but has used flexibles on ceilings—where they are out of reach—with advantage. This is usually done in bedrooms by placing the ceiling rose on the wall, close to the ceiling, and suspending the lamp from it in any position desired by an insulated hook fixed in the ceiling. A ceiling-switch alongside operated by two cords is also an advantage. A single fitting consisting of a combination of a ceiling-switch and ceiling rose would make a better, cheaper and neater job. Is there such a fitting on the market?

In the discussion on the recent papers at the I.E.E., Mr. Price (Cambridge) stated: " . . . The revenue with a house wired throughout was only about 3s. per lamp." Can you give the revenue for a three-pint electric kettle and a 4-lb. flat-iron used in an ordinary household?

We all know what the consumption of current is, but have only a remote idea of the number of units such apparatus will enable us to sell, year in and year out. I admit that the units are liable to vary between wide limits, but what is required is statistics of a large number of such apparatus. Such are now available where separate meters are used for heating and cooking.

When we receive inquiries for electric light we can easily estimate within 10 per cent. the revenue such light will yield. With small undertakings in poor towns it is absolutely necessary to know this.

On the other hand, as to the number of units that one can safely calculate on selling for each electric kettle, flat-iron, &c., only very vague ideas prevail or are obtainable.

A. B. C.

Auto-Transformer Design.

May I revise the title of the above work slightly, and commend it to your notice as "A Practical Handbook for Manufacturers, Contractors, Wiremen *and Reviewers?*" Your reviewer may be pardoned if the subject is a new one to him, but what he does not know about the practical and manufacturing side of auto-transformers would fill a considerably larger volume than the above-mentioned, and surely it is a pity to waste nearly a whole page of the ELECTRICAL REVIEW in making this so obvious!

The criticisms are nearly all too puerile to call for any serious reply, and I must decline to be "drawn" to the extent of a verbal sparring match, such as the recent example in these same columns.

Two years' experience in the design and manufacture of auto-transformers under the severest competitive conditions, and a fairly intimate acquaintance with other designs and designers' work, are likely to carry more weight than the hair-splitting and incomplete phrase-extracting your reviewer indulges in.

The proof of the pudding is in the eating; may a better digestion await him in the coming festive season than was evidently present when he penned his critique.

To save misunderstanding, let me say also that I have no intention of continuing this correspondence, and your reviewer is very welcome to the last word on the matter.

A. H. Avery.

Tunbridge Wells,
December 11th, 1909.

The Fetish of the Steady Job: A Rejoinder.

The article under the above heading, which appeared in the ELECTRICAL REVIEW of November 19th, has aroused considerable criticism, which though not particularly favourable, is very gratifying, since it is proof that some thought has been given to a subject which had not previously exercised the minds of the contributors to the discussion. The practically unanimous condemnation of some of the principles expressed in the original article will give food for thought to those who have found the remarkable truths underlying all of Ibsen's writings, and will recall to mind his most famous dictum that the minority is always right.

The letter of "A.C. Circuit" is so childish in its construction and so petty in its argument, that readers might safely be left to form their own conclusions; but for its own benefit and for that of any who may be equally misguided, it will be as well to point out some of the more striking and elementary of the fallacies expressed.

The remark that there must be equality of opportunity before the best of us can rise, implies that "A. C. Circuit" has never heard of men making their own opportunity, whereas it is absolutely undeniable that nearly all who are successful have done so, and that men who are so handicapped that it is nearly impossible for them to make their mark in the world, scarcely exist. In any case, making the opportunity is part of, and the first step towards, success, and is in fact the beginning of the rise and cannot be dissociated from it.

"A. C. Circuit" attempts to disprove the statement that men work for their own benefit, by reference to the great inventors, and writers, apparently oblivious of the fact that he is descending from the rule to the exception, and is simply proving the argument that he wishes to defeat. Does he not see that those who work solely for the benefit of mankind (and they are very few, and certainly do not comprise all the great inventors, many of them work for fame) have already reached the state of supermanhood, which is just what it is desired that all men should attain?

The two paragraphs concerning the Americans are self-contradictory and scarcely need comment. We read that United States is "a country gifted with natural resources," and the majority of its inhabitants seem to be "semi-engineer-travellers who . . . end by getting themselves and their firms into a mess." Such a combination does not often produce greatness, and it will scarcely be admitted that natural resources are of much use without the aid of capable men to develop them.

"A. C. Circuit's" knowledge of the world and people seem to be peculiar and unfortunate, and one can only be amused at his interpolation of "men with hair-brained schemes dashing about . . ." which has obviously no reference to the matter. It would be thought that only hare-brained men do anything so foolish, but "A. C. Circuit" apparently has the idea that this is the method of the successful man.

In the course of an inspiring peroration we are told that "men with a preponderance of brain power . . . shriek and scramble . . . in their efforts to pile up profit for someone else." This is somewhat original; in the experience of most people, clever men do not shriek and scramble, nor do they usually work for the gain of others.

The keynote of the whole letter is given by the trite remark that the world is "for the use and enjoyment of all its inhabitants," which, though very generally accepted, is about as degenerate a philosophy as it is possible to imagine, and those with no higher conception of the objects of life are much to be pitied; but fortunately there is always time to learn even when one "is middle-aged . . . and has the privilege of forming and moulding the minds of his children."

It is rather unfortunate that Mr. Prentice has introduced the personal element, which should be entirely lacking if one wishes to arrive at any useful conclusions, and it need scarcely be said that the writer had not the least intention of advocating a system to suit his particular case. Mr. Prentice is clearly under a misapprehension in implying that the writer desired to bring "all men up to the same standard," and it certainly was not stated that there should be "one hard and fast rule for all alike." The argument was that, as Mr. Prentice himself admits, there is good in most people, but that good is not put to its utmost use by the possessors of the steady job, simply because it would not benefit them to do so. The fact of causing all men to exert themselves to their fullest capacity, by making it impossible to live otherwise, would not bring them all up to one standard, but would bring each man up to *his* highest standard, which admittedly does not occur without incentive. On no grounds whatsoever could this be deemed anything but an improvement on the present lax state of existence. The example mentioned of the "wonderful mathematician . . . of a nervous temperament" can hardly be considered as destructive criticism of the main point at issue, and it is highly probable that the only effect of a more strenuous life upon such a man, would be to render his ideals more practical, and thus enhance his actual value to the world at large—in other words, he would benefit the many at the expense of the few. Mr. Prentice has also quite failed to realise that nervousness like slackness would soon die a natural death.

The point raised regarding selfishness makes it apparent that no differentiation has been made between worthy and worthless selfishness. The latter, which is one of the predominant features of modern life, and particularly that portion of it represented by the holders of the permanent positions, consists in living entirely for self, and adding nothing to the advancement of the world—usually, in fact, detracting from it. In the former, as was clearly pointed out in the original article, the aim may be personal, but the result is universal advancement, and surely the selfish man who moves the world, is on an infinitely higher plane than the unselfish one who is a cause of retrogression, by retarding the efforts of others.

The short letter of "J. P. F." is full of mistakes. His "object in life" is, to say the least of it, feeble and one-sided; his idea of the steady job is contrary to that of most people. No inventors are specialists, and versatile men are not "jacks-of-all-trades."

There is an underlying fallacy in the whole of the "philosophy of the ordinary man" of "John Smith" which is somewhat similar to that of the previous contributors. Of course, it is the ordinary man who counts, if the holding back of those who are naturally supermen can be called "counting," which was obviously not the interpretation intended. To say that the writer desired to set up a social system, suited only to the talented and not to the commonplace, is very misleading, since it is just the ordinary men who would be raised in the struggle for existence, and all their latent talents now fettered by the security of the steady job would be forced out automatically.

The concluding paragraph indicates that "John Smith" has not grasped the real meaning of the article. The difference in the calibre of men will always exist, and the classes will remain much as hitherto, but in each class, whether it comprise those who build houses or those with the highest mental endowments, there will be more rapid advancement when the necessity of advance is forced upon it. This will have the further effect, which must not be lost sight of, that the advance will not only be material but to a probably even larger extent spiritual, since the putting forth of all one's energies will lead to a contempt for the minor phases of life and an altogether higher aim, which is the ultimate result to be attained.

The very involved logic from which it is deduced that those who are trampled on, cause injury to the higher men, is inapplicable to the matter, since it is no more the fault of the men who have risen, that the degenerates are forced out of existence, than it is the fault of a horse who knocks down a man standing deliberately in front. Just as the one has the muscular power to move, so has the other the vital power to exist.

The thoughtful criticism of "S" offers no reflection on the cardinal points. The main contention is that a race of supermen is impossible, and this need not be denied since it does not affect the question. It must be remembered that "race" does not mean "generation," and that when all are supermen in the highest sense of the word, the race ceases, which, of course, fully explains Nordau's rather elementary statement. This being so, it is evident that the very extraordinary state of affairs of supermen fighting with superhuman energy for the super-permanent jobs need not be seriously considered—except perhaps in a future novel of H. G. Wells, who no doubt could do full justice to such a stirring episode. The point missed by "S" is that men will not become supermen at the same time.

There is certainly a very wide field for the mediocre men, and that is precisely why they should be roused to a sense of their possibilities; but in order that they may have any success they must cease to be mediocre in the present-day meaning of the term, and one can hardly talk about "wide fields" in connection with a man who spends the greater part of his life in the same daily vocation and whose ultimate worth to humanity is insignificant. The cases cited, of engineers without education who have added to the perfection of machinery, are but instances of embryo supermen, and it will be found that these little improvements have been carried out by the fighting men and not by those who have no incentive to move onwards.

The statement that in permanent jobs there are better systems of routine, in most instances implies that the number of men employed is greater than necessary, and it is undeniable that quite a large proportion of those in such positions are unproductive; that is, the actual value of the work they do is less than the amount they are paid.

The principle of the detrimental influence of the steady jobs is entirely corroborated by the remark that they are frequently held by "men who were supermen when they were young;" in other words, the effect of the steady job is to convert a possible superman into a degenerate.

The argument that supermen are devoting their energies to retaining the lives of lunatics and the physically unfit, has no bearing on the case, since it is not the object of the work of these supermen, but the result of a deficient social system over which they have no control.

A. P. C.

The "Contract Demand" System.

With reference to your comment on my letter *re* the "Contract Demand" system in the current number of the Review, let me hasten to assure you that the conditions here are not quite so Utopian as you might otherwise imagine. The price I quoted is our maximum tariff figure, and it does not follow that we always get this! Then, again, we give considerable reductions on a sliding scale, so that for large consumers the price works out at 9d. per 30-watt lamp per month for all-night burning.

These prices include the Government tax of ½d. per B.T.U. Steam coal costs us nearly 40s. per ton, while the income-tax is actually 2s. 4d. in the £ (nominally it is 4s. 2d.!).

On the other hand, thanks to an overhead system and the total absence of any Board of Trade Regulations, our services cost us on an average about 8s.

With regard to the vexed question of metallic-filament lamps (which, owing to the courtesy of the makers, we had in use here before they were on the market), I consider their advent an unmitigated blessing, it having raised the standard of illumination to such an extent that the diminution in consumption has been negligible, although, in addition to the "*à forfait*" system, we are supplying 800 consumers on the flat-rate system, for which our price varies per B.T.U. according to conditions. We have not, however, introduced the 25-volt system, as we consider that it tends to reduce the standard of illumination.

We undertake free wiring on the "*à forfait*" system, or by meter if with an annual minimum guarantee.

I have read with much interest your abstract of Messrs. Handcock & Dykes's paper; but on one point I must disagree with the authors, viz., the feasibility of a dusk-to-dawn supply. We started here by supplying from dusk to 2 a.m., but this we soon had to extend to dawn, and after about

three years, found ourselves obliged to give a continuous supply. There are dark corridors and basements to be considered, even in the sunny south! A common practice out here is to run a separate line, which can be switched off during the day, and this, with an overhead system, is quite simple.

In our agreements for the contract system, we fix a minimum fine in case of fraud, as it is otherwise difficult to prove more than nominal damages, and it is not, as a rule, wise to sue for theft under the penal code.

It may, perhaps, interest Mr. Wilkinson to know that our smallest limiter has a minimum capacity of 0·07 ampere, and will cut out with an increase of 0·03 ampere. I hope soon to forward a description of the instrument.

W. A. Brodie.

San Remo, *December 6th*, 1909.

The Socialistic Bogey.

By the tone of your leader in the current issue, one is led to believe that the "Socialistic Bogey" has at last filtered through to the Editorial sanctuary. You ask, Whither will it lead us?" Why, where the people will. What effect will it have upon trade and industry? Stimulation, by increasing the purchasing power of the people through a more scientific distribution of wealth, which is created by the combined efforts of Capital and Labour.

Is it "catching on"? You should have seen Snowden addressing crowded meetings of workmen at Tunstall on Sunday, and you would have received an eye-opener. What can we do to prevent its advance? Nothing! May as well take a broom and try to stem the rising tide; and this state of things has been produced by the brutal unorganised competitive system, which is wearing us out by a slow process of attrition; as I write, there, laying before me, is the inevitable:—Dear Sir, Owing to improved methods we are now offering 10-H.P. motors at £25. The improved methods, no doubt, means a few more hands displaced, and the ranks of the unemployed with a few more recruits.

There are no "Wicked Rich"; what is proposed is to tax the ultra rich up to to 20s. in the £ on all incomes above £5,000, if necessary, for there cannot be ultra rich unless there are abject poor. The "flitting" of "capital" from our shores is really too good to answer; but that the masters have been taught to combine is the best example of Socialism I know. They economise, co-operate, and once or twice a year reckon up and "divide the profits."

Stoke-on-Trent.

Electric Driving of Textile Factories.

Your issue of the 10th inst. contains a letter from the Council of the Bradford Engineering Society, the extraordinary contents of which require immediate correction. The words "full inquiry" and "very carefully considering" which appear respectively in this letter and in the document described as "the Report of Special Committee" on "Electric Driving of Textile Factories," seem to the gentlemen responsible for these publications to have a different meaning from that ordinarily connected therewith. We can only reiterate that this document has been published without our knowledge or approval, and does not represent the views of the Committee. The actual facts regarding its origin are as follows:—

The substance of the clauses on pages 5, 6 and 7 was, with certain reservations, adopted by the Committee merely as a basis for a discussion at a future meeting of the society. The matter on pages 3 and 4 (to parts of which we take strong exception) was issued after the last meeting of the Committee, and there is no justification or authority for including this as part of the Committee's report.

The Council now state that a meeting took place subsequently, in which this report was finally adopted. This statement is exceedingly surprising, as the undersigned members of the Committee cannot trace having received any notice of such a meeting. In fact, we have since learned from the secretary that the last meeting of the Committee took place on July 30th, whereas the typewritten copy as reproduced on pages 3 to 7 of the printed report was not issued until the 31st, and was not previously seen by the Committee. This disposes of the Council's statements and of their claim to have since made a full inquiry.

Whilst waiting for the meeting of the Society, we found ourselves suddenly confronted with the broadcast Press publication of the "Report" which had not, and would not, have received our signatures. In addition, it is headed by an "Introduction" of an entirely biased character, which has never even been submitted to the Committee. We, therefore, reluctantly adopted the only course open to us—*i.e.*, to dissociate ourselves publicly from this document.

The letter from the Council of the Bradford Engineering Society concludes with personal remarks and the insinuation of trade advertisement, the taste of which is quite in keeping with the methods adopted in the publication of the "Report." In this connection it is significant that the meeting of the Council which decided on the issue of this letter consisted of eight mechanical engineers, and that the only electrical engineer on the Council did not receive any notice of the meeting.

H. Ellis,
H. A. Jones,
R. Pohl,
T. Roles,
C. W. Salt,
W. B. Woodhouse.

Bradford, *December 10th*, 1909.

LEGAL.

Welsbach Case Settled.—Summonses Withdrawn.

At the Clerkenwell Police Court on Saturday, after a protracted hearing and several adjournments, the summonses against the Welsbach Incandescent Gas Light Co., of Gray's Inn Road, W.C., charging them, under the Merchandise Marks Act, with applying a false trade description to their electric lamps, were withdrawn by arrangement. The proceedings were initiated by the Wolfram (Tungsten) Filaments, Ltd., and the General Electric Co., and the prosecution arose out of an advertisement issued by the defendants. It was alleged that this advertisement and the use of the words "Welsbach" and "Aur" on the electric lamps sold by the defendants, were calculated to lead people to believe that they were invented or manufactured by Baron Welsbach or the Auer Co., of Berlin.

Mr. Rufus Isaacs, K.C., Mr. Colefax and Mr. Lunge appeared to prosecute. The defendants were represented by Mr. A. Walter, K.C., and Mr. Bodkin.

Mr. Rufus Isaacs said he had had an opportunity of discussing the matter with Mr. Walter, and he proposed to take a course which he hoped would meet with his worship's approval, and which he hoped he would think was proper in the circumstances, having regard to the investigation that had already taken place. They had realised that it must necessarily be, and had already been a long, protracted and expensive inquiry, and that between firms such as he represented, and the firm represented by Mr. Walter, there ought to be some means of arriving at a settlement of a dispute of that character, so that they might avoid the necessity of continuing the proceedings. He was glad to say they had been able to arrive at a point at which it became useless to continue the investigation there, or to ask for any judgment from his worship. His friend, Mr. Walter, would state that Dr. Auer von Welsbach was not the inventor of the electric lamps sold by the Welsbach Co., and that the electric lamps advertised by the company were not the lamps manufactured by the German Co.—the Auer Co. He accepted without reserve the statement that Mr. Walter had made to him to the effect that the defendant company had no intention of misleading any persons by the advertisement which they issued, and that they did not intend to lead the readers of that advertisement to believe either that Dr. Auer von Welsbach was the inventor of the lamp, or that it was manufactured by the Auer Co. His friend had also stated that the defendant company would not issue the advertisement in that form again, nor would they issue any advertisement containing words calculated to lead persons to believe that Dr. Auer von Welsbach was the inventor, or the Auer Co. the manufacturer, of the electric lamps that the Welsbach Co. was selling. Accepting those statements, it appeared to him that the proceedings might end by the withdrawal of the summonses.

Mr. Walter said he agreed with the remarks Mr. Rufus Isaacs had made, and he desired, on behalf of the Welsbach Co., to state that they had not the smallest intention, in issuing that advertisement, to lead persons to believe that the lamp was the invention of Dr. Welsbach, or that it was manufactured by the Auer Co. They certainly did not intend to repeat that advertisement, or anything that would lead the public to believe that. Of course, they would

continue to mark their goods with the name "Welsbach," and their trade-mark "Aur" would be continued on their lamps.

Mr. Bros, the magistrate, said he thought the parties were very wise. These inquiries must naturally be very expensive. Scientific witnesses and professional men had to be brought there at great expense, and then it was merely a preliminary inquiry to another which would have been as expensive, and perhaps more so. The time had not been wasted, if it had had the result of the parties coming to an agreement in open court. He had great satisfaction in knowing the case was now going to be withdrawn.

Mr. Rufus Isaacs: All the summonses will be withdrawn, and also the summonses that were pending against Mr. Fletcher. I accept his statement as to his having no intention to mislead.

The summonses were accordingly withdrawn.

Electrical Apparatus in Fife Mines.

Sheriff Shennan issued his decision at Dunfermline on Friday last, in the prosecution at the instance of the Home Office against officials of the Fife Coal Co., in connection with the electrical apparatus in certain pits owned by the company. The case was followed with keen interest by colliery proprietors and officials throughout the country. Two days were occupied in hearing evidence. His Lordship dismissed the complaint against C. A. Carlow, and found H. Rowan and W. E. Richardson not guilty.

The charge, it may be recalled, was to the effect that Charles Augustus Carlow and Henry Rowan, "agents" or "managers," for the Fife Coal Co., and William Edwards Richardson, colliery manager, Foulford, had permitted to be used at the Foulford colliery electrical apparatus and plant which were defective, despite a letter addressed to the company on January 30th by Mr. Robert McLaren, H.M. Inspector of Mines, directing that the electrical plant or apparatus installed prior to the special electrical rules coming into force on April 4th, 1905, should be made to conform to all the sections and rules applicable to the installation.

In the course of a lengthy judgment, Sheriff Shennan said that it appeared, and he thought the prosecution were not aware of this fact when they charged Mr. C. A. Carlow, that on July 13th, 1900, the Fife Coal Co. duly informed H M. Inspector of Mines that Mr. Henry Rowan had been appointed mines agent for the whole of their collieries in the Cowdenbeath and Kelty districts, including Foulford Pit. The appointment was explicitly given to Mr. Rowan, and therefore there was no room for the suggestion that Mr. C. A. Carlow occupied by implication the position of agent with respect to the Foulford Pit. It was fair to say that the system of division of responsibility, as described, seemed fair enough. For so large a company it was in the interests of efficiency that the supervision of the practical mining work should be committed to skilled agents such as Mr. Rowan was universally known to be. While the commercial side was attended to by the manager, he found nothing to show that Mr. Carlow's appointment as manager implicitly revoked Mr. Rowan's appointment as agent. Accordingly the case against Mr. C. A. Carlow must be dismissed.

Through a misconception as to the scope of Rule 55 of the Special Electricity Rules, His Majesty's Inspector issued no directions before the present year regarding the installation in Foulford Pit. But, following on a decision in that Court as to the effect of this rule, His Majesty's Inspector issued notices in general terms to 37 owners on January 30th, 1909. He assumed for the moment that this notice was effective as against the owners, the Fife Coal Co., but neither the notice nor a copy of it was sent to Mr. Rowan as agent, or Mr. Richardson as manager, and neither of these gentlemen was, in fact, aware of it. How, then, could Mr. Rowan or Mr. Richardson know that it was part of their duty to see that these special electricity rules must be obeyed? It appeared to him that the case for the prosecution must break down at the outset. It might have been the owner's duty to apprise the "agent" or "manager" regarding the application of the rules to the Foulford Pit, but they could not punish these officials for the owner's neglect. If, as he had already suggested, His Majesty's inspector had communicated direct with the agent, this difficulty would never have arisen. Accordingly, he must find Mr. Rowan and Mr. Richardson not guilty, on the ground that the prosecution had failed to prove the existence of a duty which they were said to have neglected.

Reviewing the case further, the Sheriff said he had serious doubts whether H.M. Inspector's letter of January 30th, 1909, was a proper direction under Rule 55, Sec. 11 (1). The terms were too general. What meaning were the Fife Coal Co.'s officials to take from the words "installed at your colliery" when they had 41 shafts, some with electrical installations before 1905, some with new installations, and some without any electrical appliances? As to H.M. Inspector's letter of May 3rd, the Sheriff holds there was no presumption that the letter reached Mr. Richardson. The importance of the letter lay in this, that it naturally led to the prosecution owing to the belief that its terms were being ignored.

A circular to 37 owners, telling them to bring their installations into conformity with the rules "from this date" seemed an extraordinary direction in terms of Rule 55, and one of doubtful validity. He made the observations in fairness to the company, and this was not a case where there was any evidence of attempts to thwart H.M. Inspector. Several of the matters complained of were just such things as would have been attended to out of deference to the opinion of H.M. Inspector.

Dealing with the alleged various defects, the Sheriff held that the charge, in view of the evidence as to the switches and fuses, was not relevant. It was matter for observation that no opportunity was given the company to remedy any defects, since the switches were never complained of till the case was brought. If the authorities regarded the question of switches and fuses as urgent, they must frame special rules, fixing the type that was to be permitted, or at least the type that was forbidden. In regard to the fixed terminal boxes, he thought it would be hard to convict a manager of negligence who innocently misinterpreted a rule on the point. He agreed with the interpretation of the respondents that a fixed terminal box was a box containing fixed terminals, and not a fixed box containing terminals. As regarded the cables, he could not hold the charge of negligence established. At the same time, he had no doubt that Mr. Nelson, the Home Office electrical expert, was right in impressing on agents and owners the urgent necessity of paying strict attention to the condition of cables. In the course of the proof there was an illustration of the ignorance of men unskilled in electricity, as to the possible risk from defects in the cables. There should be no reason for slipshod work in the electrical installation, and care should be taken to have everything kept in the best possible condition in order to protect the unskilled. Electrical experts knew how to protect themselves, but others would never realise the dangers that were involved.

Hall v. Marconi's Wireless Telegraph Co., Ltd.

On Tuesday the Master of the Rolls and Lords Justices Fletcher Moulton and Farwell heard an appeal by the plaintiff in this action from a judgment of Mr. Justice Ridley, dismissing his action brought to recover damages for alleged breach of agreement on the part of the company to use their best endeavours to procure a quotation on the London Stock Exchange of 10,000 £1 shares in the company that had been allotted to him.

The appellant appeared in person, and the defendants were represented by Mr. Montague Lush, K.C., and Mr. Wallace.

The plaintiff, Henry Cuthbert Hall, formerly a managing director of the company, claimed that he could have realised the shares at 12s. 3d. per share but for delay on the part of the company, whereas he only succeeded in obtaining an average price of 7s. 1d., and he claimed in respect of the difference.

Without calling upon counsel for the respondents, their Lordships dismissed the appeal with costs.

Phosphor Bronze Co., Ltd.

The petition by E. Austin & Son and Others, for the compulsory winding-up of the Phosphor Bronze Co., was again before Mr. Justice Swinfen Eady on Tuesday last.

Mr. Gore-Browne, K.C., in support of the petition, stated that it was presented by a number of creditors whose aggregate claims amounted to between £3,000 and £4,000.

Mr. Grover, for the company, asked for a further adjournment. Negotiations, he said, had been going on between his clients and the petitioners, with a view to a reconstruction.

His Lordship pointed out that there had already been a month's adjournment, and asked whether there was any evidence as to what had been done in the meantime.

Mr. Grover said there was not, but Mr. Gore-Browne's clients were aware of the steps that were being taken.

Mr. Gore-Browne said he had no objection to a further adjournment so long as the petition was disposed of this sittings.

His Lordship said that that was the last company day that sittings.

Mr. Gore-Browne said then he must press for an order. He had no objection whatever to a reconstruction, but thought that perhaps a compulsory order would be the best means of bringing that about.

His Lordship accordingly made the usual order.

The Electrical Co, Ltd, v. Messrs. Oliver H. Thomas, Son & Co., Ltd.

This action was continued before the learned Official Referee, Mr. Pollock, in the High Court of Justice on Monday, December 13th.

The Electrical Co., Ltd., of Charing Cross Road, London, are suing Messrs. Oliver H. Thomas, Son & Co., Ltd., of Neath, Wales, colliery proprietors, for the sum of £2,976 in respect of an electrical pumping plant which plaintiffs supplied to the Llyner Valley Colliery, belonging to the defendants at Llangonoid.

Plaintiffs allege that the contract was made between the parties by letters dated November 17th and 20th, 1905, and the contract price was to be paid as to 60 per cent. on delivery, 30 per cent. on starting the pumping work and 10 per cent. three months later. No payment had been made.

Defendants, on the other hand, denied that the contract was contained in the letters referred to. They admitted plaintiffs' claim to the amount of £1,035, and also £51 1s. 4d. for goods sold and delivered. Further, however, they declared that the plant plaintiffs supplied became defective and wholly inefficient for the work required of it at the colliery. They ordered the machinery from plaintiffs with a view of its replacing the existing steam pumping system, for unwatering the mine and enabling them to develop and work the colliery. Defendants ordered the electrical plant from plaintiffs, relying on the latter's skill and judgment to

supply suitable machinery, but this they had failed to do. Furthermore, defendants contended that the machinery was not delivered within a reasonable period, and respecting these things they had suffered great loss and damage by reason of the flooding of the mine. They counterclaimed the sum of £31,200 10s. 1d.

Plaintiffs repudiated the claim, declaring that any loss defendants had suffered was due to the bad conditions under which the plant had to work, and the unskilled labour used by them to work it.

Mr. Abel Thomas, K.C., with Mr. Sankey, K.C., and Mr. Bowen Evans were counsel for the plaintiffs (instructed by Messrs. Michael Abrahams, Son & Co., of Tokenhouse Yard), and Mr. Williams, K.C., with Mr. Meager, appeared for the defence (instructed by Messrs. Collins & Wood, of Swansea).

Mr. Sankey, K.C., in opening the case for the plaintiffs, dealt with a mass of correspondence with a view to showing that much of the delay complained of was due to defendants failing to have the site ready when plaintiffs desired to come and fix the machinery. When the plant was handed over to the defendants breakdowns occurred. On such occasions defendants would simply wait until plaintiffs sent a man to inquire into the matter. It was then invariably found that the stoppage was caused by defendants' neglect to oil and clean the machinery. Plaintiffs wrote to the defendant company complaining of the negligence of the men employed to look after the plant and repudiating the suggestion that the machinery was unsuitable. On June 17th, of 1907, the pumping machinery failed, and the mine became flooded, due, the plaintiffs alleged, to defendants' improper handling of the plant, and the bad conditions under which it was working. A fresh agreement was then made whereby plaintiffs' were to unwater the mine, and defendants to supply unskilled labour and certain materials. When plaintiffs proceeded to overhaul the machinery they found it in a very neglected condition, and the trouble, which continued after the new agreement had been entered into, was due to the unsatisfactory nature of the material defendants supplied and the labour they employed. In November a third agreement was made, defendants declaring that matters were in a serious state. Nothing satisfactory resulted, and the present action was commenced.

Hearing adjourned.

F. Suter & Co., *v.* Drake & Gorham, Ltd.

In the Divisional Court, King's Bench Division, on Thursday, December 9th, this action was before Mr. Justice Darling and Mr. Justice Phillimore. The matter came before their Lordships on plaintiffs' appeal from a decision of his Honour, Judge Woodfall, in the Westminster County Court, when the question at issue was the liability of a company for goods received after the intervention of debenture-holders, to have that liability set off against a previous debt.

Mr. Jolly, who appeared for the appellants, said his clients were a company under the Joint Stock Companies' Act, and some time ago issued debentures in the usual form. Before these debentures became due and enforcible, the company, which was carrying on business in the ordinary way, incurred a debt for something like £100 to the defendants. In March the debentures became due, and a receiver was appointed to carry on the business. Counsel contended that the Conveyancing Act of 1831, for certain purposes made the Receiver the agent of the company in such a manner as to exclude him from all liability attaching to the persons who appointed him. The Receiver was entitled to use the name of the company for the purpose of enforcing claims, but after his appointment, although the business was carried on in the name of the company, it was being carried on by the Receiver solely for the benefit of the debenture-holders. The action was brought for the price of the goods supplied after the intervention of the debenture-holders, and the question was whether as against that debt the defendants could set off a debt which became due from the company long before the debenturs-holders' action.

Without calling on counsel for the respondent (Mr. Hogg), the Court held that the Receiver for the debenture-holders was not entitled to credit all the receipts to them, but only enough to extinguish their debt, and that the defendants were entitled to set off a debt due to them against the Receiver.

The appeal was accordingly dismissed with costs.

Hufton *v.* Leeds Corporation.

On Monday Mr. Justice Bucknill had before him at the Leeds Assizes an action in which Harold Hufton, formerly head boots at the Albion Hotel, sought to recover damages from the Leeds Corporation for personal injuries received. Mr. J. A. Compston was for the plaintiff, and Mr. E. Tindal Atkinson, K.C., and Mr. J. A. Greene for the defendant Corporation.

Mr. Compston said the plaintiff's position was a rather remunerative one, for whereas his wages were only 10s. per week and board, his earnings with tips amounted to between £3 and £3 10s. per week. Late on the night of Saturday, March 6th, he got on a tramcar in Boar Lane to travel home to Wortley. As he got on the conductor was inside collecting fares, and he called out to him that he could not go upstairs because it was full. Plaintiff replied that there was nobody sitting in front, and the conductor rang the bell. A drunken man was standing on the top of the steps, and when the car started in consequence of the conductor ringing the bell, the man fell down the steps on to Hufton, who was ascending, but had only reached the third step. Had the conductor not stopped Hufton by saying there was not room on the top, he would, said counsel, have got safely past the drunken man before the car started. Hufton was thrown back on to the platform, his head and neck being jammed against a rail, and he was very seriously hurt. He had to remain in bed for about two months, and during his illness he was so violent at times that he had to be held down by four or five persons. In June, when able to resume work, he found that his employer had filled his position, and it was not till July 5th that he found he would get employment at Huddersfield. As a result, said Mr. Compston, the plaintiff had lost 14 weeks' wages, which, reckoned at £3 10s. a week, amounted to £49, and in addition serious expense had been incurred for medical advice, nursing, &c.

For the defence, it was suggested that the plaintiff should have got off the car when told it was full, and that the accident was not due to negligence on the part of the Corporation's servants. A point in the case was as to whether the man who fell down the steps was drunk.

Mr. Justice Bucknill had a word of sympathy for the lot of the tram conductor. On wet nights, when there was a rush for the shelter of the cars, he was a man to be pitied.

The jury found for the plaintiff for £100, and judgment was given accordingly.

Gould *v.* Lehwess.

Last week the case of Gould *v.* Lehwess was opened before the Court of Appeal, composed of Lords Justices Vaughan Williams, Buckley and Kennedy, upon the defendant's appeal from a decision of Mr. Justice Phillimore in the King's Bench Division.

Mr. Gore-Browne, K.C., and Mr. R. J. Willis appeared for the appellant, and Mr. J. R. Atkin, K.C., and Mr. D. C. Bartley for the respondent upon the appeal (the plaintiff).

Mr. Gore-Browne, in opening the case for the appellant, said it was an appeal by the defendant from a judgment for the plaintiff for £2,528. The judgment was in respect of an agreement dated April 28th, 1908, whereby the defendant promised to secure that the Electrobus Co., Ltd., or some other company, would purchase some electrical storage batteries, the property of the plaintiff, and if the Electrobus Co. or some other company did not pay for them the defendant would, subject to the batteries passing a satisfactory test. The story was a very complicated one. The plaintiff, Commodore Charles Gould, was an American, and was President of an American company called the Gould Storage Battery Co. Defendant was Dr. Lehwess, a doctor of science, a German, who had been naturalised in this country for a good many years. Defendant was the principal proprietor of another company which supplied the vehicles to the Electrobus Co. In November, 1906, defendant went to America on the authority of the company to negotiate a contract for getting any battery that might be better than those they were then using, and in that way defendant got into communication with the plaintiff. It appeared from the statement of the learned counsel that on November 1st, 1906, the defendant and the plaintiff agreed to form a company in England to be called the Gould Storage Battery Co., and plaintiff's case was that the company should have a cash capital of £25,000, the plaintiff to have 55 per cent. of the shares fully paid up. That company was registered on November 20th, 1906, with a nominal capital of £26,000. On November 30th, 1906, the plaintiff sent the defendant a cable as follows:—"Do I understand £25,000 in cash has been paid in?" to which the defendant replied on the same day, "All shares issued cash, about 4,000 reserved." Plaintiff alleged that defendant meant to convey that the company was possessed of £21,000 as cash capital. Plaintiff alleged that in consequence of this representation he delivered to the company 15 sets of batteries and accessories, whereas the fact was that the company had not any cash capital, as none of its shares were issued for cash. Plaintiff accordingly claimed that as the company had not paid for the batteries, &c., the defendant by virtue of an agreement made on April 28th, 1908, was liable to pay for them.

In reply to Lord Justice Vaughan Williams, Mr. Atkins said the plaintiff's case was that in consequence of the misrepresentations of the defendant, he had parted with the batteries to the Gould Storage Battery Co., and had, therefore, lost the value of them. Plaintiff's other cause of action was against the defendant on the contract of April 28th, 1908, and upon that the plaintiff was entitled to damages. Plaintiff further said that the defendant had himself prevented the tests of the batteries being carried out within the specified time.

At the conclusion of the arguments on Wednesday last week their Lordships gave judgment.

Lord Justice Vaughan Williams said the Court was of opinion that there ought to be a new trial. It was not usual when a new trial was ordered for the Court to go into matters that had been discussed before them on appeal, because if they went into them it was almost impossible to avoid making observations which might be calculated to prejudice the new trial. He would state broadly why he believed a new trial should be ordered. He was clearly of opinion himself that the damages should have been assessed otherwise than they had been. Apart from any measure of damages applicable in the case, he thought that there was not sufficient ground for leaving out of consideration certain portions of the evidence that had been given. Further than that he hesitated to make any observations as to the conclusions he had come to upon a great many matters which ought to have been dealt with on the best evidence. The best evidence was not given. He would direct a new trial upon the usual terms that the costs would abide the result.

Lord Justice Buckley agreed. He said he was extremely sorry that there should be a new trial, and he came to that conclusion with great reluctance, but he was not satisfied that the damages had been properly ascertained.

Lord Justice Kennedy concurred.

The judgment in the Court below was accordingly set aside, and a new trial was ordered, the costs to abide the result.

An application for a stay with regard to costs in the event of an appeal to the House of Lords was refused.

F

SOME POINTS IN RELATION TO ARC LAMPS.

[COMMUNICATED.]

The arc lamp, although it was one of the earliest forms of electric lighting, has throughout the years of the electrical industry been subjected to an almost endless succession of changes, and it may be partly due to the fact that this change has been going on, and also to the variation in the systems of supply, that even at the present day there are points about the use of arc lamps on central station supply systems which have yet to be overcome. If this were not so, the task of the superintendent of the arc lamp department would be rendered a very nominal one, so from the point of view of the maintenance engineer it is, perhaps, as well that there are one or two difficulties still left.

One of the systems upon which public arc lamps are supplied is the series circuit, with provision for compensating the voltage should one or more of the arc lamps in series fail to operate properly. One of these systems which was very much to the front a few years ago, and is still in use, is the rectified current system, by means of which a series of arc lamps are supplied direct from an alternating-current station, with a constant current, fluctuating but unidirectional, and, therefore, as the periodicity is usually pretty high, suitable for use with a continuous-current lamp. When everything is working properly this system is a very simple one, but it has troubles which now and again render the life of the engineer not altogether devoid of excitement. For example, one case occurred where direct-current street arc lamps were run in groups of lamps in series on a high voltage, and the alternating current was rectified at the generating station in the usual way. Unfortunately, however, a trimmer in cleaning one of the arc lamps managed to leave out a wire from one of the lamp resistances. In this way the circuit was broken in spite of the fact that automatic short-circuit devices were attached to each lamp. The result of this slight omission was that when the rectifiers were switched in at night the open circuit on one group of lamps managed to find a weak place in the insulation of one of the coils, and proceeded to burn it out, with consequent disaster to that group of lamps.

Another defect which a series system of street lighting has is that although the voltage available on the terminals of any lamp will not exceed 50 volts, it is quite possible to get a pressure to earth on certain parts of the circuit exceeding this value many times over, and it is therefore evident that the insulation of the whole circuit must be of a first-class nature. Moreover, it is highly necessary from the point of view of public safety to see that any iron work in connection with the lamps is thoroughly well earthed, as otherwise a passer-by might get a violent shock. This is not an altogether visionary idea, as in one such instance, where an earth occurred on a lamp-post which was fairly near the high-tension end of a series supply, quite perceptible shocks were obtained from the arc lamp column by a person standing upon the pavement. It would appear almost impossible for the potential difference between the lamp-post fixed in the ground and the pavement itself to be great enough to administer a shock, but this actually was the case, and the advisability of connecting arc-lamp columns on such systems to efficient earth plates in damp ground was amply demonstrated.

A very usual system of supply both for street and private arc-lamp lighting at the present day is either by means of direct current on a series of lamps at 200 or 400 volts, or by means of small transformers fed from the high-tension mains, the low-tension side of which is connected to each individual lamp or to a small group of lamps. In a good many cases small individual transformers are used, and where these are adopted they are often turned out rather cheaply, so perhaps one ought not to grumble at their little imperfections. It is, however, possible in a good many cases to obtain slight shocks from the corners of these transformers, and upon investigation it is sometimes found that the wires leading from the coils to the terminals are insulated, or supposed to be insulated, by stringing black glass beads upon the bare flexible conductor. In many cases these beads touch the cover or some other portion of the transformer. A little reflection will show that if any damp happens to be about, the formation of the surface of the beads and the fact that a short path to the potential-charged conductor is offered through the crevices left between adjacent beads, tends to collect the moisture and to put the conductor into almost direct connection with the earthed portions of the transformer. In spite of the fact that short circuits and shocks can easily be obtained from this cause, the method of insulation has so much to recommend it on the score of cheapness that it is very far from being abolished, although, in the interests of a supply system, it is hardly to be recommended.

A feature which is bringing considerable anxiety to the engineer in charge of an arc-lamp system, is the heavy strain which is being put upon the earning capacity of arc lamps as current-consuming devices. This factor is a very important one in connection with the revenue production of an electricity supply system, and it may be urged that some of the offers which are being made to private consumers for the purpose of inducing them to adopt arc lamps, say, for shop-window lighting, are verging upon the farthest limit of safety with regard to profit and loss. Let us try to investigate a typical instance, which is not by any means an exaggeration of terms which are being offered publicly to consumers in supply areas. Suppose that an electricity supply authority in running an arc lamp rental system offers a flame arc lamp with, in the case of an alternating-current distribution, the necessary transformer, together with carbons, maintenance, repairs and energy for a maximum of, say, 800 hours' burning per annum, at a price varying between £8 and £9 per year. It will occur to many readers that this is a low figure, but it is believed that similar, if not exactly the same, rates could be found upon inquiry among the supply authorities operating at present. It must be remembered that the arc lamps are put upon the mains at precisely the same time that the ordinary peak load is present—that is to say, between the hours of 5 and 11 in the winter, and about 8 and 11 in the summer. It is, therefore, proper to rate the value of the energy at the ordinary lighting tariff, and a figure which may be fixed for the purpose is of the order of 3½d. per unit. As such flame arc lamps suitable for burning outside shop windows take about 3 amperes, the energy alone for 800 hours at this rate totals a charge of about £7, and it is to be supposed that most of the consumers who adopt this system will run their lamps at about the maximum number of hours. On the top of this is the fact that the lamp itself, if it is of any good make, will cost something like £6 ; while a transformer, if this has to be supplied, will work out at about £2 to £2 10s. It can hardly be assumed that the life of such rental lamps and transformers can be more than three years, so that there is a pretty heavy interest on capital and depreciation to pay out of the balance. Moreover, in the winter, the time of a man sufficient to call every morning to re-carbon the lamps and to effect any necessary running repairs has to be taken into account, while in the summer it is probable that the man will have to call about three times a week. It does not appear that on such terms arc-lamp rentals are a paying proposition, and it is, therefore, a matter of surprise that so many supply authorities appear to be considering similar propositions. The way in which this affects the arc lamp maintenance engineer is that he is inevitably called upon, in view of the fine limits on which the supply is being run, to cut down the costs of his work to the very finest limit ; it will readily be seen that this is unjust, and a very onerous task is placed upon the practical man who is called upon to eliminate by close attention to duty any trouble the financial effect of which has not been allowed for in an original estimate of cost.

Italy.—La Société Electro-Métallurgique Piémontaise is the title of a new company which has just been formed in Brussels, with a capital of £100,000, to acquire the rights in the Froment process for the electro-metallurgical recovery of gold from auriferous ores, and to take over the demonstrating plant at Domodossola, Italy.

THE RIGHT TO CUT OFF THE SUPPLY.

[BY A LEGAL CONTRIBUTOR.]

One of the most important privileges conferred upon the "undertakers" who supply electricity to the public is that which enables them to discontinue the supply, in a case where the consumer refuses to pay rent or otherwise misconducts himself. This right may be exercised in a variety of circumstances. Thus it is provided by Sec. 21 of the Electric Lighting Act, 1882, that if any local authority, company, or person neglect to pay any charge for electricity, or any other sum due from them to the undertakers in respect of the supply of electricity to such local authority, &c., the undertakers may cut off such supply, and for that purpose may cut or disconnect any electric line or other work through which electricity may be supplied, and may, until such charge or other sum, together with any expenses incurred by the undertakers in cutting off such supply of electricity as aforesaid, is fully paid, but no longer, discontinue the supply of electricity to such local authority, &c.

The period when the meter rent is to become due and payable is usually settled by the contract between the parties. Thus the undertakers may require payment of their accounts quarterly, monthly or weekly.

The Electric Lighting (Clauses) Act, 1899, also makes provision for the cutting-off of supply in certain events. By Clause 27 (3) of the schedule to that Act, which is incorporated with nearly every provisional order, the undertakers may, after they have been giving a supply of energy in respect of any premises, by notice in writing, require the owner or occupier of those premises, within seven days after the serving of the notice, to give to them security for the payment of all moneys which may become due to them in respect of the supply, in case the owner or occupier has not already given that security, or in case any security given has become invalid or insufficient; and in case any such owner or occupier fails to comply with the terms of the notice, the undertakers may, if they think fit, discontinue to supply energy for the premises, so long as the failure continues.

There is one other event in which the undertakers may cut off the supply, and to state the circumstances is to state the justice of the case.

Clause 27 (4) of the schedule to the Electric Lighting (Clauses) Act provides that if the owner or occupier of any premises uses any form of lamp or burner, or uses any energy supplied to him by undertakers for any purposes, or deals with it in any manner, so as to interfere unduly or improperly with the efficient supply of energy to any other body or person by the undertakers, the undertakers may, if they think fit, discontinue to supply energy to those premises so long as the lamp or burner is so used, or the energy is so used or dealt with; the Act also provides that the undertakers are not to be compelled to give a supply of energy to any premises unless they are reasonably satisfied that the lines, fittings and apparatus therein are in good order and condition, and not calculated to affect injuriously the use of energy by the undertakers or by other persons.

Any expenses incurred in cutting off the supply of electricity may be recovered summarily as a civil debt; and, of course, it is competent for the undertakers, instead of bringing pressure to bear upon a defaulting consumer by cutting off, or by threatening to cut off, his supply, to recover the amount due by summary process in a police court.

The right to cut off, and the threat to exercise this right, are, however, most effective remedies in the hands of the company, and so long as the consumer is not arbitrarily treated, there is no hardship upon him. The proper way to test the matter is to consider what would happen if the company were bound to go on giving a supply whether their lawful charges were paid or no. In that case it might be incumbent upon the undertakers to continue a supply until every little claim which they might have against the consumer were tested and enforced in a court of law. Unless, however, they exercise the power judiciously, they lay themselves open to unfavourable comments from the Bench; for they must go to Court if they wish to enforce payment. In a case in 1903, which was heard by his Honour Judge Emden, it appeared that in the latter part of 1901 an installation of 14 16-c.p. lamps was put in a consumer's house. Of these six belonged to the supply company. The agreement stated that 2s. per quarter should be the rent of the meter if 20 8-c.p. lamps, or their equivalent, were used, to be increased to 3s. per quarter if over 20 8-c.p. lamps, or their equivalent, were used. It appeared that the consumer, after some time, and without the consent of, or notice to, the company, changed his installation to three 16-c.p. lamps and 12 8-c.p. lamps. Upon doing this he refused for six quarters to pay more than 2s. per quarter meter rent, and eventually, on May 19th, his supply was cut off. In giving judgment for the consumer when he was sued by the company, his Honour Judge Emden thought proper to make the following observations: "I cannot allow this case to pass without saying that it is impossible for a public Corporation to carry on business if they abuse their powers in this way. Here we have a responsible gentleman, an officer who has been in her late Majesty's army, who has always paid his way; not a word can be said against him, and on a trivial claim for 6s. he is put to the disgrace of having his light cut off. The Corporation has a monopoly; it is entrusted with great powers, but if it exercises them in such a way, it is unfitted to be entrusted with such powers." We confess that we do not altogether share the view expressed by his Honour; but, at the same time, the case may act as a warning to supply companies not to exercise their powers in an arbitrary manner.

NEW ELECTRICAL DEVICES, FITTINGS, AND PLANT.

Patent Flexible Cast-Iron Pole.

We recently mentioned that a new type of pole had been invented by Mr. J. H. Skinner, of Imperial Buildings, Gardiner Street, Durban; we are now enabled to illustrate the pole, which

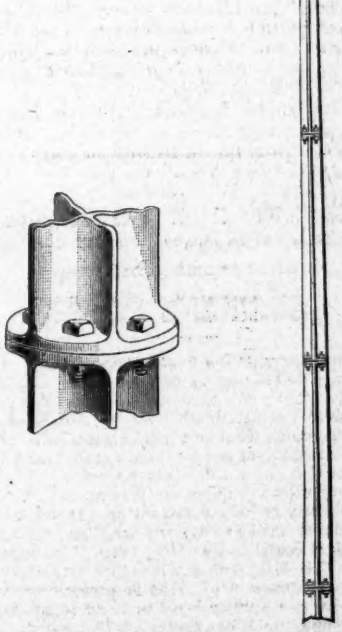


Fig. 1.—Detail and Elevation of Cast-Iron Pole.

can be made of cast or wrought-iron, or steel. The figures sufficiently show the construction of the device; the number of sections employed depends upon the length required, each section being about 5 or 6 ft. long. Tests have been carried out before the Postmaster-General of Natal, the Corporation of Durban, and the Acting Chief Engineer of Johannesbury,, and a trial order has been

placed with the inventor by the Government of Natal. It is claimed that the poles are cheaper than the tubular type, very flexible, portable, adaptable, and, when of cast-iron, exceedingly durable.

In the Durban tests, two poles were erected with four telephone wires between them, and the poles were guyed back until there was a stress of 320 lb. on each of them; in order to give the poles a violent jar, the guy wire was then cut, and the overhead wires pulled the poles about one foot out of the perpendicular. A single guy was then attached to a pole, and it was pulled over two feet out of the perpendicular, to which it returned when released. The pole was finally broken, in three places simultaneously, with a pull of 500 lb.—four times the normal. The length of the pole was 20 ft. (16½ ft. above ground), and the weight about 179 lb.

The Rotasphere.

The KINETIC CO., LTD., of Kinetic Works, Lincoln, have devised a novel method of applying electric power to organ blowing. As illustrated, the electric motor is fitted with a hemisphere of polished aluminium, which drives by friction a bicycle wheel with an ordinary pneumatic tire. The latter affords an ideal member for a frictional drive, and we believe this is the first example of its use for this purpose. The motor is mounted on a swivelling carriage, revolving about an axis tangent to the tire, so that in every position the hemisphere is in contact with the latter, the gear ratio varying from zero in the position shown to a

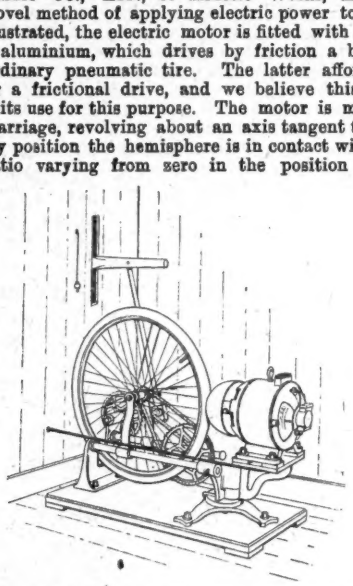


FIG. 2.—THE ROTASPHERE FOR ORGAN-BLOWING.

maximum when the motor is turned through a right angle, with perfectly smooth gradations; the carriage is rotated by a cord connected with the bellows, so that the speed is highest when the bellows is nearly empty. The motor is shunt-wound, and therefore runs at practically constant speed, while the speed of the wheel is reduced by means of sprocket wheels and chains, the last wheel actuating the bellows handle through a crank and connecting rod. The device, it will be seen, is extremely simple, and in running it is almost inaudible. There is but little wear on the tire, which therefore lasts a long time. The efficiency is very high, a ½-B.H.P. motor being capable of providing an ample supply of wind for an organ of ordinary size. Ball bearings are used throughout, and the parts are all standard cycle fittings. The floor space required is 45 × 16 in., and the height 33 in.

New Tantalums.—MESSRS. SIEMENS BROS. DYNAMO WORKS, LTD., are now putting on the market, and they hold stocks at their works at Tyssen Street, Dalston, an entirely new grade of tantalum lamps as follows, at a reduced price:—

50 volts to 120 volts	.. ..	10 C.P.
140 volts to 160 volts	.. ..	16 C.P.
20 volts to 60 volts	.. ..	5 and 10 C.P. (a candle lamp).

They are also introducing a range of tantalum battery lamps.

BUSINESS NOTES.

Book Notices.—*Hazell's Annual*, 1910. Twenty-fifth year of issue.—Edited by Hammond Hall. London: Hazell, Watson & Viney, Ltd.—We need write little at this date regarding the serviceableness of this book. We have perused a number of the sections in which we take a more particular interest, and find them profitable reading as reminders of events that have happened, and tendencies that have been observed, during the past year, and if, as we believe they are, other sections are equally correct, then we shall frequently be helped in hunting up references to matters with which we may not be so directly familiar and upon which we may require light occasionally during 1910. The section on "Electricity Supply" is brief, but it will suffice to give the uninitiated reader a correct impression of what is proceeding in that department, and there are similar brief sections regarding telephones, wireless telegraphy and the cables of the world. In a section entitled "The March of Science," Sir Oliver Lodge discusses "Physics in the New Century." "The Evolution of the Flying Machine" is handled by none other than Sir Hiram Maxim, and a great deal of other and very interesting material regarding aerial navigation in 1909 appears, together with instructive illustrations. But these are only a fleabite of the matters covered in this "cyclopædic record of men and affairs" revised to November 30th. There is a very full index, and its whereabouts is plainly indicated by a blue edging. We congratulate the editor and publishers on another useful edition of this widely-used book.

The Annual Report of the Glasgow and West of Scotland Technical College for the past year contains views of the magnificent buildings of the college, the third section of which has been finished and occupied. The fourth section will be ready for occupation in September next year. An expenditure of £362,083 has been incurred, of which some £40,000 remains to be raised. During 1908-9 there were in attendance 487 day students and 4,623 evening students, as well as 714 pupils of Allan Glen's School. In electrical engineering there were 940 students—122 day and 818 evening. Prof. M. Maclean is the head of the department, with Mr. F. H. Downie, B.Sc., as chief assistant. A sandwich system is in force in the engineering department, whereunder the day students enter works from April to September. In a report to the Education Department Prof. Perry speaks in the most eulogistic terms of the equipment and *personnel* of the departments of mathematics, mechanics and engineering.

"Proceedings of the Physical Society of London." Vol. XXI, Part V; October, 1909. London: Taylor & Francis.

"Science Abstracts." Sections A and B, Vol. 12, Part 11; November 25th, 1909. London: E. & F. N. Spon. Price 1s. 6d. each part.

"Who's Who, 1910." London: A. & C. Black. Price 10s. net.

"Who's Who Year-book, 1910." London: A. & C. Black. Price 1s. net.

"Writers' and Artists' Year-book, 1910." London: A. & C. Black. Price 1s. net.

"Englishwoman's Year-book, 1910." London: A. & C. Black. Price 2s. 6d. net.

"The Shot-firer's Guide," by W. Maurice, President of the Institution of Mining Electrical Engineers, is being issued by the *Electrician* Printing and Publishing Co., Ltd., London, price 3s. 6d. net. As its title implies, it is a book of instruction for colliery officials regarding the use of explosives, and contains much information on the electrical methods and apparatus employed.

Russian Exhibition.—The Russian Exhibition in London is being vigorously pushed. Mr. Crisp, one of the founders of the Anglo-Russian Trust, according to a St. Petersburg paper, and Mr. Hartley, manager of the Earl's Court grounds, have arrived in St. Petersburg on business connected with the Exhibition in question. It is stated to be the intention of the organisers of the Russian Floating Exhibition, that is about to leave Odessa and visit the Near East ports with specimens of Russian goods, to take advantage of the Russian Exhibition in London next year, and at its close to make a round of the English ports as a continuance of the Exhibition.—*The Financier.*

Christmas Holidays.—MESSRS. BRUCE PEEBLES & CO., Ltd., announce that their works at East Pilton will be closed from December 24th to January 4th for the holidays. No goods will be received or despatched, and only urgent correspondence will be dealt with.

Catalogues and Calendars.—DEWHURST'S ENGINEERING CO., LTD., Sheffield.—Three most acceptable wall calendars have been received from this firm. Those electrical men who receive any of these will find the subject extremely interesting—to say the least—and those who receive them all will for a while be in a dilemma as to which is the best to grace their office walls. Some, according to predisposition and temperament perhaps, may affect to favour "Lily of Killarney"; to others "The Old Breakwater" will more particularly appeal; but that fascinating picture of "A Village Scene in France," from a painting by Albert Wallet, makes one, as one contemplates it, feel that it is indeed good to be alive. We congratulate the company on their excellent selections.

MESSRS. SIEMENS BROS. & CO., LTD., Caxton House, Westminster.—Catalogue No. 519, "Telephone Switchboards," describing types suitable for private telephone installations of all sizes, from four lines to 250, including private branch exchanges allowing a proportion of the stations to communicate with the local or trunk exchange. The larger sizes are suitable for small towns, and both magneto and battery calling systems are provided for, the latter including the common-battery system, which is generally used in installations for 100 users and upwards. Accessories and spare parts are also listed, and illustrations and prices are given. The catalogue is in the form of single sheets, held by fasteners, so that other sheets can be added as they are issued. Catalogue No. 517, Section II—"Kalkos" conduits. This is a companion to Section I, which dealt with "Metacase" conductors. A very wide range of fittings and accessories is illustrated, the system being very flexible and adaptable to a variety of requirements; special attention is drawn to the advantages gained by combining the Kalkos and Stannos systems, where the wiring has to be watertight throughout, and adapters are provided to facilitate the combination. Where concentric wiring is permissible, either system or both combined can be employed, the Kalkos tube having ample carrying capacity.

THE WARDLE ENGINEERING CO., 196, Deansgate, Manchester.—New lists of "Streetlite" specialities for metal-filament lamps, including fittings for station platform lighting, shop window reflector lighting, watertight fittings, brackets and globes; also of the "Carlite" electric side and tail lamps.

CHICAGO PNEUMATIC TOOL CO., CHICAGO.—Leaflet describing the Franklin high-speed air compressor.

MESSRS. SOUTHAM & WOOD, LTD., 162, Oxford Street, W.—Pamphlet illustrating the "Zephyr" self-contained electric fountains and cascades for decorative and advertising purposes. They are supplied in marble, bronze, silver, terra cotta or stone.

The Electrical and Engineering Supplies Co., Ltd., 36 and 37, Upper Thames Street, E.C.—Two recently issued price leaflets showing their electric flashing signs for shop windows, counters, &c., also their decorative outfits for interior decorations (Christmas tree and shop-window) with miniature electric lamps.

The Davis Electrical Co., Ltd., 17, Moor Street, Charing Cross Road, W.C.—Thirty-two page illustrated catalogue and price list of electrical steel conduits and accessories; also lists of "Attracta" electric signs, Chamberlain's anti-vibrator, and the "Ellco" invisible lamp lock.

The Premier Accumulator Co., Ltd., Cattle Market Road, Northampton.—New catalogue (for 1910) wherein in the course of 24 pages are contained particulars rendered descriptively and in tabular form of the Premier accumulators of the central station type, also those for country house lighting, shipand yacht lighting, traction cells, train lighting, ignition and portable lighting batteries. Dimensional drawings appear of cells and wood stands, also prices of renewals and accessories, testing instruments, acid, &c.

Mr. J. Conway Price, of 151, Fleet Street, E.C., who is known in the electrical trades as a technical advertising specialist, has sent us a folding leaflet relating to his work as a designer of advertisements and giving a list of electrical firms who are using his designs. Copies can be obtained on application by any advertiser.

The Key Engineering Co., Ltd, Trafford Park, Manchester.—Twelve-page red covered pamphlet describing and giving illustrations of their system of "solid" protection for underground cables.

Messrs. Donovan & Co., Barwick Street, Birmingham.—Illustrated price leaflets relating to cast-iron and watertight fittings, Barwick motor-starters and motor-starting panels, and iron-clad fuseboards.

Mr. G. Braulik, 8, Lambeth Hill, E.C.—Leaflet showing the "Eclipse" flame arc lamp with an ornamental case in green relieved by bronze, and hexagonal type globe. Mr. Braulik is now representing in the United Kingdom and in English possessions abroad, Messrs. B. Paege & Co.,of Berlin, manufacturers of electrical insulating varnishes, cabling compounds, &c., and he will keep a stock of these in London, both in bulk and in small tins. A catalogue and number of leaflets relating to these products has been received, and copies can be obtained on application.

Messrs. Hawksley, Wild & Co., Ltd., Brightside Boiler and Engine Works, Sheffield.—Two new publications; one a leaflet containing a brief general description of the "Suckling" water-tube boiler; the other a 20-page catalogue giving a fuller and much more detailed description of the same boiler, with some fine examples of half-tone printing. Types of tube cleaners, and a report of a test on the boiler by Messrs. Burstall & Monkhouse, also appear.

Messrs. Bruce Peebles & Co., Ltd., Edinburgh.—Booklet No. 706 (28 pages) in the company's standard form in two sections. The first half is occupied with a description, with many half-tone illustrations, of the works at Edinburgh; the other half contains illustrations, with brief letterpress, of dynamos and motors, turbo-alternators, motor converters, and other manufactures made therein.

General Electric Co., Ltd., 71, Queen Victoria Street, E.C.—Pocket booklet of 12 pages, giving illustrations and prices of a number of patterns of electric radiators and elevators made under the "Archer" system.

Cowper-Coles Engineering Co., Ltd., 82, Victoria Street, London, S.W.—A number of illustrated lists in binding cover, giving descriptions of the following manufactures:—Centrifugal pumps for acids, acid valves (corrosion proof), filter economisers, atomising plants, aluminium welding process, acid injectors, and a patent motor headlight.

Accumulators for Central Stations. — The D.P. Battery Co., Ltd., inform us that during the past 12 months they have installed, or have now on order, batteries for 20 central stations, including a large battery of over 2,500 ampere-hours capacity at 550 volts for the Corporation of Dudley, as well as others for the East Indian Railway at Howrah, of 862 kw.-hour capacity, for the Colonial Government at the Bahamas, the Liverpool and District Co., Manchester Corporation, and nine installations for Australia.

Admiralty Work.—Maxwells, Ltd., Dundee, have been placed on the Admiralty list for work, and since the arrival of the submarines several repair jobs have been sent to their establishment.

Conversazione.—The directors of Messrs. Rawlings Bros., Ltd., of Gloucester Road, South Kensington and Belgravia, gave a conversazione on Saturday evening last to their employés and their wives and friends. These, to the number of some 400, met at the Cabins Restaurant, Caxton House, Westminster, where a musical entertainment, largely contributed to by the employés themselves, had been arranged. An excellent programme of music and song was thoroughly enjoyed. During an interval, light refreshments were handed round, and conversation and laughter were indulged in without restraint, the occasion being one for real social intercourse.

The New Exhibition Building for Manchester.—We have received from Mr. W. Davenport, of Ridler Place, Holland Street, Blackfriars, S.E., particulars of the scheme to erect a large Exhibition Building for Manchester. It is stated that the work of erection will be commenced next month. A well-placed site has been secured in Old Hall Lane, and a handsome building, with a floor surface of 100,000 sq. ft., for which the plans have already been passed by the Corporation, will be erected. The proprietors of this building have already secured contracts for four important undertakings, and the scheme has so far commended itself to those business men who have been approached in the matter that it has been unnecessary to ask the public for a single penny of the capital involved. The scheme of erecting such a building had its genesis in the successful Electrical Exhibition that was held in October last year, and the architects of the present building have based their plans largely upon the requirements there shown to be necessary. Manchester, the second city of the Empire and the centre of the great manufactures of the North, will soon, therefore, have an Exhibition building suitable to its importance as a centre of commerce. The contract for the building has been placed with Messrs. Davenport, Sons & Co., of Birmingham. The contracts already entered into are for the Manchester Industrial Exhibition, May 12th to June 25th, 1910, which is being organised by the International Trade Exhibitions, Ltd.; the Great Textile Exhibition, October 8th to 29th, 1910, promoted by Mr. H. Greville Montgomery, M.P.; from November 16th, 1910, to April 30th, 1911, a skating rink; and in May and June, 1911, a General Engineering and Allied Trades Exhibition organised by International Trade Exhibitions, Ltd. The building will be 600 ft. long × 180 ft. wide, lighted by electricity and fitted in an up-to-date style in all departments.

Trade Announcements.—Messrs. H. Jaggar & Co., electrical engineers, of Halifax Road, Dewsbury, have opened new business premises in Henrietta Street, Commercial Street, Batley.

The Adnil Electric Co., Ltd., have appointed Mr. James Turnbull, of 3, New Street, Birmingham, their agent for the whole of the Birmingham district, including the counties of Warwickshire, Worcestershire, Shropshire and Staffordshire.

Dissolutions and Liquidations.—Mackey's Electric Lamp Co., Ltd.—This company is winding up voluntarily, with Mr. W. Bean, of 174-175, Aldersgate Street, E.C., as liquidator. A meeting of creditors will be held at Manchester Hotel, Aldersgate Street, on December 24th,

The Electrical Orb Finding Co., Ltd.—A meeting is to be held at Suffolk House, Laurence Pountney Hill, E.C., on January 17th, to hear an account of the winding up from Mr. J. D. A. Norris, the liquidator.

Messrs. W. Tully & Howard Straker have dissolved partnership. Debts, &c., will be attended to by Mr. Howard Straker at the office of Mr. W. Tully, 16, Water Lane, Great Tower Street, London, E.C. Mr. William Tully continues in business as a mica importer and dealer on his own account as Wm. Tully & Co., at the above address.

Uxbridge and District Electric Supply Co., Ltd.—By an order of the Court, Messrs. J. O. Callender (Callender's Cable Co.), and W. A. Bird and J. C. Saunders (Metropolitan Electric Supply Co., Ltd). were appointed a committee of inspection to act with the liquidator.

Morris-Hawkins Electrical Co., Ltd.—A meeting will be held at 58, Coleman Street, E.C., on January 12th, to hear an account of the winding up from Mr. E. I. Husey, the liquidator.

F. Burks & Co., manufacturers of electrical machines, apparatus and devices, 37, Port Street, Manchester.—Messrs. F. Burks, F. C. Poulton and V. Bramwall have dissolved partnership. Debts will be attended to by F. Burks & Co., Ltd., of the same address.

LIGHTING and POWER NOTES.

Amble.—At a meeting of the U.D.C. on the 9th inst., Mr. Wanless moved that the Council was prepared to proceed with the erection and equipment of an electrical installation for lighting and power purposes within the urban area. The motion was carried.

Australia.—The Perth (W.A.) City Council has given notice of its intention to obtain Parliamentary powers to take over the gas company's undertaking (which includes both gas and electricity supply). The gas company's estimate of value for its property ranges from £137,000 to £236,000.

As a result of street lighting experiments in Sydney, the electrical engineer advises that arc lamps should be retained in the main thoroughfares, but that flame arcs be substituted for open type. The cost of metal lamps for such situations would be excessive, but these lamps should be adopted in side streets which may be lighted in future. The cost of altering the arc lamps is placed at £3,000.—*Australasian Hardware and Machinery.*

Ayr.—The proposal of the T.C. to extend the use of electric lighting in the streets of the burgh was opposed at the last meeting by Mr. Wm. Smith, who pointed out that in 1895, before the electricity works were started, the cost of lighting the burgh was £1,500, whereas it was now £4,837. He admitted that the town was better lighted, but held that it could be lighted with incandescent gas burners at half the cost. Mr. Smith did not get a supporter, and the proposal was carried.

Brighton.—The Lighting Committee has recommended the T.C. to enlarge the plant at the Southwick Works by the addition of a 3,000-kw. set, &c., at an estimated cost of £14,500, and to provide additional plant for the North Road sub-station at a cost of £3,500.

Burnley.—On Saturday last the extensions carried out by the Corporation Electricity Committee during the last two years were opened by the Mayor, who has been chairman of the Electricity Committee for seven years, and Mrs. Hargreaves, wife of Councillor T. W. Hargreaves, vice-chairman of the committee, started the new 750-KW. generating set. The supply of electricity was commenced in August, 1893. Extensions became necessary in 1895, and in 1899 it was found that the capacity of the plant would very soon be overtaxed. A change was, therefore, made, and the distribution converted from a three-wire system with 220 volts, to one with 440 volts. Burnley was one of the towns which paid a royalty for using the three-wire system. In 1901 electric tramcars were running, and by 1903 all the old steam-driven tramways had been converted, and some new branch lines opened. In 1904 the station load had increased to warrant another extension, and a 500-KW. Belliss-Dick, Kerr generator and an additional boiler were installed. The last new set consists of a Belliss engine coupled to a Dick, Kerr multipolar generator. The condenser, of the Westinghouse-Leblanc type, is one of the largest of its kind installed in the country. The boiler-house extension includes provision for six Lancashire boilers, pump room for two feed pumps, economiser, coal and ash handling plant, &c.

Caerphilly.—The B. of T. has informed the U.D.C. that it has received objections to the proposed transfer of the E.L. order to the South Wales Electric Power Distribution Co. The Council has replied that the Council is in favour of the scheme, but the three members of the Town Ward were not. The latter have asked the B. of T. to hold an inquiry into the matter.

Canada.—After a long fight in the City Council, lasting all night, the City of Hamilton has decided unanimously to enter into a contract with the Ontario Hydro-Electric Power Commission for 1,000 H.P., on terms outlined by the Commission. This was one of the cities which recently sent a delegation to the Federal Government to have the Hydro-Electric Power Bill vetoed.

The Ottawa Electric Co. has obtained a 10-year contract to light the town of Eastview at the same rates as charged in Ottawa.

Carmarthen.—The Carmarthen Electric Light Co. has been formed with a capital of £10,000 to supply the borough with electric light and power, and the company has acquired an existing prov. order. At present the town is lighted by gas, but the company has entered into an agreement with the T.C. for the lighting of the street lamps by electricity, and the Council has consented to the use of overhead mains throughout the borough. The contract price for the electric installation is £7,205. Mr. S. G. Leech, M.I.E.E., of Westminster, is the engineer.

Carnarvon.—At a meeting of the T.C. last week, a letter was read from the National Electric Construction Co., with whom the Corporation has an agreement giving it the option of acquiring the electric light works at the expiration of the stated alternative periods, reporting favourably upon the progress of the works, in spite of the trade depression. If this progress was to be ensured, representations must be made for the necessary borrowing powers for extending the works. It was also suggested that the electricity be utilised for street lighting, the estimated cost of installing eight arc lamps being £400, and the annual cost of lighting £150. The matter is to be further considered.

Chadderton.—With regard to the application of Oldham T.C. to supply consumers in Chadderton, the B. of T. has informed the Council that it has no power to grant a prov. order, as Chadderton Council has refused its consent. The Board added that it was prepared to consider the question of making an order in respect of any application from would-be consumers.

Chippenham.—The B. of T. has informed the T.C. that as there did not appear to be any early prospect of the Council exercising the powers of the E.L. order, it is proposed to revoke it.

Cookstown, Co. Tyrone.—At the meeting of the Urban Council on the 6th, a motion to take the necessary steps to supply electricity for public use was defeated by 6 votes to 5. It is understood that the coming elections will be fought on the electric lighting question, a large number of the ratepayers being in favour of the latter.

Edinburgh.—After considering Sir Alexander Kennedy's report as to the future working of the Dewar Place and M'Donald Road stations, with special reference to the cooling towers, the Electric Lighting Committee has decided that in view of the new principles involved, the Council before committing itself to any decision should send a deputation to London and Birmingham, where the new type of plant mentioned by Sir Alexander in his report is in operation.

Glasgow.—Owing to the impossibility of securing proper hall accommodation, the T.C. has postponed the proposed exhibition of electric and gas lighting, heating, and cooking appliances till autumn of next year.

Grimsby.—The Public Lighting Committee has decided in favour of borrowing £2,000, so that the street lighting may be carried out by metallic-filament lamps in all streets where electric mains are laid, and that the existing arc lighting be brought up to date by the introduction of flame arcs. Various reductions to private consumers, the maximum reduction being ¼d. per unit, are proposed.

Govan.—It is reported that the T.C. has agreed to extend its electricity plant at a cost of over £9,000.

Huddersfield.—The T.C. has decided to apply for a prov. order for electric lighting in the South Crosland district.

Kendal.—The L.G.B. has forwarded to the T.C. sanction to a loan of £1,976 for electricity purposes.

Leyton.—Without appeal, the U.D.C. has secured a reduction in the assessment of the electricity works from £3,302 to £3,150.

London.—HAMMERSMITH.—The Council has agreed to increase the accepted contract price (£660) for the coal-handling and storing plant by £90 for various alterations and additions, and also for the contractors (Messrs. Fraser & Chalmers) to undertake the erection of the plant. The charge for the 400-C.P. metallic-filament lamps now fixed in the Grove is to be reduced from £20 per lamp per annum to £17. The Electricity Department has saved, by converting the system from the ordinary arc lamps to metallic-filament lamps, £40 per annum, which is equivalent to £2 16s. per lamp per annum. The charge for public lighting in side streets has been fixed at £2 14s. per lamp per annum for current, maintenance, &c. The question of granting special terms to consumers taking a large amount of energy per annum for lighting purposes has been considered, and it has been decided to give the following discounts off 3d. per unit, the general rate charged:—When the amount exceeds 20,000 units and does not exceed 30,000 units per annum, 2½ per cent; 30,000 and not exceeding 40,000, 5 per cent.; exceeding 40,000, 10 per cent.

ST. PANCRAS.—The L.C.C. has drawn the attention of the B.C. to the fact that the whole of the surplus on the electricity undertaking in 1908-9 was transferred to the relief of the rates. The B.C. is asked, when considering the disposition of any further surplus from the electricity account, to bear in mind the large amount of loans which have been borrowed, mostly for 42 years—a period much in excess of the life of mains, machinery and house services—and that 72 per cent. of the loans are on the annuity system of repayment, whereby the burden of repayment is heavier in the later years of the loan period than in the case of the instalment system.

STEPNEY.—The Electricity Committee has presented a report by the borough electrical engineer relative to necessary extensions of the generating plant, owing to the rapidly growing electricity supply in the area. The engineer points out that the units generated during the year 1908-9 exceeded the estimates for 1909-10 (viz., 7,500,000 units). The Council has also pledged itself to give a stand-by supply to the Poplar B.C. at Christmas, 1910, of 600 KW., and including this the estimated maximum load will then be 4,900 KW. Under the circumstances, the engineer estimates that the following expenditure will be necessary:—

BLYTH'S WHARF—		
Boilers and accessories	£9,630	
Chimneys, fan draught, economisers and flues	3,984	
Steam and other pipework	2,700	
Generating plant	10,280	
		£26,594
OSBORN STREET—		
Converting plant	3,600	
Switchgear, cables, &c.	1,075	
		4,675
WAPPING SUB-STATION—		
Converting plant	3,500	
Switchgear, cables, &c.	1,850	
Travelling crane	200	
		5,500
Total, exclusive of land and buildings for Wapping sub-station		36,819
Contingencies and engineering charges		3,681
Grand total		£40,500

This estimate does not include the cost of the land, buildings or cables for the Wapping sub-station, the site of which has not been fixed. The new plant should be available by September 30th, 1910; it includes three extra marine type boilers, chimneys, fans, economisers, &c., switchgear, and a 2,000-KW. turbo-alternator and condensing plant, which will utilise all the space provided in the existing Blyth's Wharf building; also a third converter and switchgear at Osborn Street and a sub-station at Wapping for the riverside load. As a result of the additional financial charges, a small deficit is expected in 1910-11.

Loughborough.—The accounts of the Gas and Electricity Committee of the T.C. for the last half-year show an increased profit of £339, as compared with the corresponding half-year.

Merthyr.—The Merthyr County Council has accepted the tender of the Merthyr Electric Traction Co., as against that of the Dowlais Gas Co., for the public lighting of Dowlais.

Oldham.—The Lancashire Electric Power Co. has informed the T.C. that it is prepared to give permission for the Council to supply electricity in the urban districts of Crompton, Royton, Chadderton, and Lees, and in the rural district of Limehurst in all cases where it does not exceed 50 H.P. In cases where applications for power exceed that amount, special permission should be applied for. The T.C. regards the offer as a very generous one.

Portsmouth.—Application is to be made to the L.G.B. for sanction to borrow £24,000, the estimated cost of new mains and public lighting works during the next three years.

Oldbury.—The Shropshire, Worcestershire and Staffs. Electric Power Co. has applied to the B. of T. for consent to the use of overhead 5,500 and 400-volt three-phase transmission lines for the supply of energy to the Brades Steel Works, Oldbury, Griffin Foundry, and the Pump Houses at the U.D.C.'s Sewage Works.

Ravensthorpe.—The Lighting Committee has recommended the U.D.C. to give the Yorkshire Electric Power Co. notice to discontinue supplying electricity to customers for lighting purposes in the Council's area.

Royton.—The U.D.C. has consented to energy being supplied to consumers in the township by Oldham T.C., provided that the same price is charged as to consumers at Oldham.

Saltburn.—The U.D.C. has asked the Cleveland Power Co. to quote terms for the supply of electricity in bulk for public and private lighting.

Singapore.—The Straits Settlement Government, in connection with its harbour improvement scheme at Singapore, has equipped an electric power station and installed 1,700 B.H.P. of plant for driving workshops, pumps, cranes, coal-handling, lighting, &c. The work has been carried out under the supervision of Mr. F. R. Marsh, the Harbour Board's chief electrical engineer.

Stretford.—Mr. T. L. Miller has been re-appointed consulting engineer to the electricity undertaking for one year at a fee of 25 guineas.

Walkden.—Following upon the adoption of electrical driving by Messrs. E. Lane & Sons and Messrs. J. Booth & Co., of the Hope and Bridgewater Mills, Walkden, a correspondent states that two other prominent manufacturing firms here are also arranging to have extensive electrical installations put down.

Walsall.—The electrical engineer reports that by the regulations issued by the Home Office considerable alterations will be required at the high-tension switchboard in the generating station, as well as several minor precautions for guarding the exposed portions of the H.T. system. The matter is to stand over until the decision of the L.G.B. is received to the application for the loan of £35,000, as it is possible that the alteration, if now made, will afterwards be found to be useless.

West Ham.—In October last the Council wrote to the Woolwich Borough Council asking for facilities to supply energy in bulk to the Port of London authority. Woolwich Council has now replied to the effect that it hopes to be in a position to give a supply to the North Woolwich area in the near future, and for this reason it is not prepared at present to favourably consider West Ham's request for consent to the supply of current for use in an area controlled by the Woolwich Council. The town clerk of West Ham is to apply to the Board of Trade under these circumstances for consent to give the supply in question to the Port of London authority under the provisions of the Electric Lighting Acts (Amendment) Act, 1909.

Weymouth.—The T.C. has applied to the L.G.B. for a loan of £500 for mechanical stokers, and £1,500 for mains extensions for three years.

Worksop.—At Monday's meeting of the U.D.C. the Lighting Committee presented a report from the electrical engineer respecting an application from the Worksop Co-operative Society for the electric supply to be extended to the site of the Co-operative Gardening Society, and recommended the Council to accede to such application. The recommendation was adopted, and it was resolved to make application for sanction to acquire an additional loan of £1,500 for purchasing cables, meters, &c.

TRAMWAY and RAILWAY NOTES.

Accrington.—Last week the chairman of the Electricity Committee stated that the revenue from the electric cars last half year had been sufficient, for the first time, to meet the charges; the Committee had decided to set apart for the depreciation and renewals fund, in addition to making the provision required for the current needs of the service and the redemption of the debt. The gross income was £12,708, and the gross expenditure £11,904. There was a net profit of £804 for the six months, or something more than a penny rate. For the financial year ended last March the deficiency was £1,216.

Aston.—A special meeting of the T.C. was held last week for the purpose of affixing the seal of the Council to an agreement between the U.D.C. of Handsworth, the City of Birmingham Tramways Co., Ltd., the Aston Council and others, in relation to through running powers over the Birchfield Road and Villa Road lines. The town clerk pointed out that another body concerned in the matter was the South Staffordshire Tramways Co. He referred to the award made by Mr. Graham Harris in relation to the purchase of the cable tramways on Soho Hill, and on in the direction of Birmingham by Handsworth; an award which has been already dealt with in the Review. Continuing, Mr. Ansell said Handsworth had promoted a Bill in this session of Parliament under which it would continue a line of tramways, commencing at Trinity Church, and forming a physical connection with the existing line there. The line would join the cable route at Soho Hill. It had agreed to link up the Villa Road line with the cable route, so that the Black Country traffic might be brought along this portion of the line, and so to the east and north-east ends of the city, and to Gravelly Hill, Erdington, &c. Handsworth was bound to carry out this part of the agreement by December, 1911, under the penalty of having to pay £2,000 liquidated damages to the Aston Corporation. Alderman M. Evans moved the resolution adopting the agreement, and Alderman Smith seconded. The motion was agreed to.

Australia.—A commencement has been made with the Prahran-Malvern (Vic.) electric tramway which will connect two suburbs of Melbourne.

Belfast.—The proposed line from Belfast to the top of the Cavehill—the very prominent mountain which overshadows the city—would measure 3 miles 1 furlong, and the estimated cost is as follows:—Construction, £56,400; equipment, £20,000; machinery, £5,150; road-making, £29,700; total, £111,550. It may be of interest to add that the first railway ever made in Ireland—now derelict—runs along part of the proposed route. It was used for conveying the stone, used at the building of the harbour, from the quarries at the base of the mountain, and was worked by an endless chain and barrel engine.

Black Country.—The question of "fair fares" is causing considerable commotion in the district, and the matter was referred to at the meeting of the Dudley T.C. last week. Councillor H. W. Hughes stated that the farthing stages had been discussed by the Tramway Committee, and it was not at all clear to the members whether the system would be applied to Dudley, or if it would be a benefit supposing it were applied. Councillor Tanfield said the system would increase the cost of travelling 50 per cent. The town, he went on, were to receive £1,000 in rental from the B.E.T. Co., and under the new proposal the people would pay three times that amount. Mr. Tanfield also complained of the completion of a lease of the lines to the company, which had not been explained to the general body of the Council. Dudley, it may be added, is a most important tramway centre, as lines running to Cradley, Stourbridge, Wolverhampton, Tipton, West Bromwich, and Birmingham, *via* Oldbury, converge there.

Bradford.—A deputation of the members of the Tramways Committee has returned home after a 3,000 miles trip on the Continent, the object of the journey being to study tramway systems abroad. The tour embraced Berlin, Vienna, Munich, Milan, Verona, Lake Como, Basle, Strasburg, Cologne and Brussels.

Continental Notes.—France.—The Compagnie des Chemins de Fer de l'Ouest having presented a scheme for the electrification of the lines running to Saint Germain and Argenteuil at a cost of 61 million francs, including the generating station, the State Railways Administration has adopted it with two modifications set out in M. Chaigne's report on the State railways. The first modification refers to the underground station at Saint Lazare, estimated alone to cost 18 million francs, which is held to be unnecessary, the existing station being considered of a capacity sufficient for a much greater amount of traffic than is at present offering, and than would be offering were all the lines on the right bank of the Seine electrified. With regard to the second modification, while the Western Railways scheme only contemplated the electrification of the line to Argenteuil and Saint Germain, the new one involves the electrification of all the lines on the right bank. The total cost is put at 67 million fr. for the electrification proper, including the generating stations, and seven millions for road works. The expenditure will be spread over the years 1910 to 1914. A beginning of the works will be made next year, for which a credit of two million francs will have to be provided.

Austria.—Sanction has been accorded by the Austrian Ministry of Railways for the preliminary surveys for the following electric lines:—To the Council of Teschen, for a narrow gauge electric railway in the township of the same name; to Herr Anton Modler for a narrow gauge electric railway from Ober Leutensdorp to Rauschengrund; to the Oderberg T.C., for a narrow gauge steam or electric railway, for the carriage of passenger and parcels only, from Oderberg station to Deutschleuten; to the Salzburg Rail and Tramway Co., for a normal gauge electric railway from Salzburg by Maxglan, to the frontier opposite Gross-Gmain; and, lastly, to the Commune of Stenico, for a projected "Judikarien" railway connecting Bagni di Comano, Campo Maggiore, Stenico, Ragoli, Preore and Tioni.

Bosnia.—The firm of Langen & Co. has made application for water rights on the Zeljeznica River with a view to generating current for a projected electric tramway to run from Sarajevo to Ilidze.

Norway.—A concession has been granted by the Bergen municipal authorities for an electric cable railway for passenger traffic from the town to a spot on the mountain side overlooking the harbour. The work is to be completed by September 1st, 1910. The name of the concessionaire may be obtained at the Commercial Intelligence Branch of the Board of Trade.

Switzerland.—An electrical funicular railway of metre gauge is projected from Coire to Mittenberg.

Italy.—The director of Sicilian tramways has submitted a proposal for the temporary reopening of the Messina tramways; a new company is to be formed to electrify the Giampreleri-Messina-Faro line and to construct additional lines.

Argentina.—It is reported by telegraph from Buenos Ayres that Congress has just approved the concessions for the construction of two underground electric railways in that city. As far as one scheme is concerned, it is stated that a group has been formed to finance it, consisting of the Crédit Mobilier Francais, of Paris, the Banque de Reports de Fonds Publics et de Depôts, of Antwerp, the Comptoir de la Bourse, of Brussels, and the firm of Th. Bracht & Co., of Antwerp and Buenos Ayres. The group recently commissioned the latter firm to take the necessary steps to further the project, which has been proposed by the municipal Council, and the concession for which is sought by the firm in question, on the one hand, and by the Anglo-Argentine Tramways Co. on behalf of the Compagnie Générale des Tramways de Buenos Ayres, on the other. The second project concerns the Eastern Railway Co., whose terminus is situated at the Plaza de Setiembre 11th, and which has resolved to continue its railway underground to the harbour as an electric line. This particular scheme was approved by the Chamber on the condition that it should solely be an extension of the existing railway, and should not prejudice the projected municipal undertaking, and both of these proposals have now apparently been sanctioned by the Upper House.

Dudley.—Prior to the prorogation Parliament passed an Act enabling the Corporation to purchase the whole of the tramway lines within the borough, and to lease them to the B.E.T. Co. for a term of 30 years. Originally the agreement with the company, known as the "Dudley Agreement," should have come into operation in 1904, but, unfortunately, it has been the subject from time to time of serious litigation, a question with respect to the Netherton line having to be carried to the House of Lords for settlement. The Corporation, it is now stated, requires a loan of £93,000 to carry out the purchase and to pay the incidental costs. The rent which the company is to pay will, it is anticipated, meet sinking fund and interest and leave a profit to the ratepayers of £1,000 per annum.

Dunfermline.—It was reported at the District Committee meeting that the road surveyor had had a conference with Mr. Balfour, of the Dunfermline and District Tramway Co., and that the latter had agreed to pay the Committee £400 in respect of extraordinary traffic and damage to the roads. The Committee resolved to opposed the prov. order for the running of tramways to Rosyth along the Grange Road.

Edinburgh.—The burgh engineer reports regarding the extension of the tramways from the terminus at Gorgie to Slateford Road, that Messrs. Dick, Kerr & Co. are of opinion that, subject to the bridge-work proceeding as rapidly as was expected, there was nothing they could foresee likely to cause delay in the opening of the new length of tramways for traffic by May 1st next. The Tramways Committee gave instructions to push on the work as speedily as possible.

Glasgow.—The general manager (Mr. Dalrymple) has submitted to the T.C. a list of 11 non-paying routes on the Corporation's tramway system. The average revenue per car-mile on each route for the year ending May 31st, 1909, ranged from 7·840d. to 9·849d. The T.C. decided that the service on those routes be so arranged that, while giving a reasonable service, the present loss in working would be minimised as far as possible.

Isle of Wight.—According to the *Times*, a conference of public authorities has approved proposals for the improvement of the local railway system by electrical working, but the railways have not yet mentioned their terms.

Japan.—According to German Consular information the Kobe-Akashi Electric Railway Co., with a nominal capital of about £210,000, intends to build an electric railway from Kobe *vid* Suma to Akashi, a distance of 11½ miles. The first section of 5½ miles is to have a double track, the rest of the line a single track.

The Minomo-Arima Electric Railway Co. proposes to build an electric railway, 15½ miles in length, from Osaka *vid* Ikeda to Takaradzuka, with a branch 2½ miles long to Minomo. The cost of the work is estimated at about £300,000.—*Board of Trade Journal.*

New Zealand.—The Invercargill and suburban ratepayers have decided to install an electric tramway system for the town and suburbs, energy being obtained from a water-power 20 miles distant. The estimated cost is £75,000.

Leyton.—The assessment of the tramways undertaking has been reduced from £4,150 to £3,500 without resorting to appeal.

Portsmouth.—The Hayling (Hants.) Light Railway Co. is applying for a further order to revive and extend the period limited by the Portsmouth and Hayling Light Railway Order, 1905, for the exercise of its powers under that order, including an extension of the periods limited by the order of 1905, for the completion of the works thereby authorised.

Sunderland (Correction).—In connection with our last week's note on the meeting of the T.C. on the 8th inst., when the Tramways Committee submitted a memorial received from the Urban District, Rural District, and the Parish Councils within the area served by the Sunderland District Electric Tramways, Ltd., in favour of running powers being granted to that company over the portion of the Corporation's system from Grangetown to Fawcett Street, Sunderland, the Committee reported that it did not see its way to recommend the Council to accede to the request.

West Africa.—It is proposed to construct tramways from Yonni to Kholifa and Rowalla to act as feeders to the Sierra Leone Railway. The lengths of these tramways will be about 30 and 50 miles respectively.—*African Engineering.*

West Ham.—The tramways manager reports that the net cost of the construction and erection of the 12 top deck covers recently completed amounted to £64 18s. 9d. each. As on previous occasions, 10 per cent. has to be added to this amount to cover establishment charges, which will make the cost of the covers £78 8s. 1d. each. The contractor's price was £97 1s., so that there was a saving of £223 14s. 7d. on the 12 covers.

U.S.A.—The New York Public Service Commission has issued regulations by which all closed street cars must be equipped with suitable electric heating apparatus to give a temperature inside between 40° and 65° F., whenever the outside temperature is lower than 40° F.

The *Detroit Journal* has recently commented on a report by the Detroit Committee of Fifty dealing with the Municipal Ownership of Tramways in Great Britain. Ten cities, including Birmingham, Edinburgh, Manchester, Liverpool, Sheffield and London, were "studied," and, according to the above-mentioned paper, "Congestion of population, high fares to sanitary districts, half-rate wages and colossal debts are the analysed results of municipal socialism in Great Britain. In return they have a low fare for a little ride, and lots of short rides bringing down the average." It is interesting sometimes to see ourselves as others see us, even if the others come from Detroit.

Eleven American interurban railways have now adopted the 1,200-volt D.C. system, the latest being the Shore Line Electric Railway of New Haven, Conn., some 52 miles long. Power is generated by Curtis turbo-generators as three-phase current at 11,000 volts and 25 cycles, and transformed by 600/1,200-volt rotaries for use on the line. The cars are equipped with 600/1,200-volt motors, and the equipment is arranged to operate at both pressures.—*Electric Traction Weekly.*

TELEGRAPH and TELEPHONE NOTES.

A.C. Traction and Telegraphs.—Experiments made on the Valtellina three-phase railway, described in *l'Industrie Electrique*, showed the general result that the effect of stray currents from the railway on the adjoining telegraph lines was quite negligible; electrostatic induction was also of small moment, but the electromagnetic perturbations were very serious. It was found necessary, when the line commenced electrical working, to provide metallic circuits for the telegraphs in the neighbourhood of the railway, with translators at the terminal points, but this was both inconvenient and expensive, and required skilled attendance to keep the translators in good working order. Nevertheless, there seemed to be no better way out of the difficulty, short of compelling the railways to use continuous current.

American Combine.—The Western Union Telegraph Co. gives the following reason for the disposal of stock to the Mackay Companies Associate, which has formed the subject of much speculation in London:—"A development since the close of the fiscal year is the sale of the company's holding with the New York Telephone Co.'s stock. The plan of that company for acquiring other telephone properties involved the raising of a large amount of additional capital by the sale to stockholders of an issue of $35,000,000 of new stock. It was thought inadvisable for the telegraph company to undertake to raise the large sum required for its proportion of the new issue, and advantage was taken of a favourable opportunity to dispose of the minority interest in the Telephone Co. to the American Telephone and Telegraph Co. In connection with this sale, arrangements have been made for retiring on May 1st, 1912, the $10,000,000 4 per cent. convertible bonds of the company, which are redeemable at the pleasure of the company on and after that date."

Brazil.—The provisional concession lately obtained by a Mr. Reidy for a cable joining Para with Fernando Noronha, thence to Alagoas, Rio de Janeiro and Sao Paulo, and ending at Chuy, has resulted in the lodging of a protest with the Brazilian Government by the Western Telegraph Co., declaring it to be an infringement of their rights.

Cables Interrupted and Repaired.—Paramaribo-Cayenne interrupted December 7th; Nagara-Kartal repaired December 8th; Bathurst-Bissao interrupted December 9th; Puerto Plata-Martinique repaired December 11th, 1909.

Cipher Codes.—An American Consular report states that the Turkish Government has decided to authorise the use of cipher codes for telegraphic correspondence exchanged between different parts of the Empire as well as with foreign countries.

Jamaica.—The annual Colonial Report for Jamaica for the year 1908-9 gives the receipts from post office and telegraphs as £40,695, as against £41,099 for the previous year, while the expenditure was £37,135, compared with £36,985 for 1907-8. The revenue from telegraphs was £6,221, an increase of 2 per cent.

The length of telegraph lines in operation was 715 miles, including railway telegraphs used for general purposes. Maintenance absorbed £935.

Turkish Telephone Concession.—The *Financial News* reports that the Austrian Telegraph Co., which sent in tenders for the telephone concession in Constantinople, has lodged a protest with the Ottoman Government against the grant of the concession to an Anglo-Franco-American syndicate.

Wireless Telegraphy.—The advantages of wireless telegraphy are to be rendered available to South American ships, which in crossing the ocean are cut off from communication with the world for over a fortnight. The work is proposed to be accomplished by a French company, which, on the one hand, contemplates the erection of a wireless station of great range at Dakar on the Cape Verde, and on the other, of a second station on the Island of Fernando Noronha, which is situated about 372 miles distant from the harbour of Pernambuco. The distance between the two stations is about 1,550 miles. A small station is to be erected at Pernambuco for connection with Fernando Noronha. As Pernambuco is the starting point for telegraph cables to all important places in South America, and as Dakar is in connection with the St. Louis cable station, a favourable means of communication in all directions is assured.

According to the *Exchange Telegraph*, direct wireless communication between Germany and Great Britain was established on Tuesday last, the Lepel system being used, with stations at Brunswick and London.

The *Times* says that the Marconi telegraph stations erected in the Italian Colonies are giving good results. Two different systems have now been completed in Somaliland, one connecting the posts at Mogadish, Itala, Merka, and Lugh, and the other connecting Brava Giumbo and Bardera. The Merka and Mogadish line is in active use for commercial as well as official messages, both Arab and Somali traders having discovered the benefit of being able to communicate quickly by its means.

CONTRACTS OPEN and CLOSED.

OPEN.

Austria.—Tenders are about to be invited by the municipal authorities of Neupaka, Bohemia, for the establishment of a large electric generating station in the town for lighting and power purposes.

Australia.—Melbourne.—January 5th. One feed-water oil eliminator for the City Council. See "Official Notices" November 19th.

Melbourne.—February 2nd. Electrically-driven pump for the City Council. See "Official Notices" December 10th.

Melbourne.—February 22nd, 1910. The Postmaster-General is calling for tenders for the erection of wireless telegraph stations on North and South Heads, Sydney, and on Fremantle Heights, Western Australia, capable of communicating with ships up to 1,000 miles.

Canterbury.—March 16th, 1910. A branching multiple magneto switchboard for the P.M.G., for Canterbury, Victoria. Commonwealth Offices in London, 72, Victoria Street, S.W.

Sydney.—January 11th. A power generating station equipment for the Lithgow Small Arms Factory, New South Wales, for the Commonwealth. See "Official Notices" December 10th.

Belfast.—January 10th. One 1,500-kw. continuous current turbo-generator and condensing plant for the Corporation. See "Official Notices" December 10th.

Bridlington.—January 1st. 300-kw. steam dynamo for the Corporation. See "Official Notices" December 10th.

Chatham.—December 23rd. Osram electric lamps for a year, for the T.C.; Borough Surveyor, Town Hall.

Cape Town.—January 5th. The Corporation requires tenders for the supply of motors for the year 1910. These motors are in connection with the hire-purchase system commenced by the Corporation two years ago. Tenders to City Hall, Cape Town.

Carlisle.—December 24th. 8,000 yards of wire, and poles for overhead transmission line for the Corporation. See "Official Notices" December 10th.

France.—December 22nd. The municipal authorities of Fontainebleau are inviting tenders for the contract for an installation of electric lighting in the Town Hall.

Italy.—January 26th. The Italian State Railway authorities in Rome are inviting tenders for the supply of 50,000 metallic-filament electric lamps.

London.—Southwark.—38-instrument central-battery telephone installation at East Dulwich Grove Infirmary for the Guardians. See "Official Notices" December 3rd.

I.E.E.—January 10th. The Council of the Institution of Electrical Engineers is inviting tenders for the interior wiring and fittings for lighting and power at its new premises. See "Official Notices" to-day.

Oldham.—Main service cable at the Workhouse for the B.G.; Taylor and Simister, architects, 29, Queen Street, Oldham.

Spain.—Tenders have just been invited by the municipal authorities of Cumbres Mayores (Province of Huelva) for the concession for the electric lighting of the town during a period of 10 years.

Switzerland.—The Swiss Budget for 1910 includes, for the Department of Telegraphs and Telephones, an expenditure on new apparatus and supplies (£50,000).—*Board of Trade Journal.*

CLOSED.

Bristol.—The City Council has accepted the tender of the Bristol Electrical Co., at £130, for the electric lighting of Alexandra School.

Canada.—Cable contracts have been awarded by the Ontario Hydro-Electric Commission to Siemens Bros. Dynamo Works, of Great Britain, to supply a 12,000-volt cable for $21,149, also a submarine cable for $1,943·12, and an underground cable for $1,556.

Chertsey.—The U.D.C. has accepted the tender of the Woking Urban E.L. Co. for the installation of the E.L. at the compressor station.

Epsom.—The U.D.C. has ordered from the Foster Arc Lamp and Engineering Co., Ltd., a number of their new "Q" type flame arc lamps, in which a number of carbons moulded together side by side are employed, so that the lamp is never extinguished when changing over from one pair to another.

London.—The L.C.C. Stores Committee has accepted the tender of Messrs. H. G. Mayer & Co., for electric carbons. Also tenders of the following for electric lamps:—Cryselco, Ltd., Edison and Swan United Electric Light Co., Ltd., Maxim Lamp Works, Pope's Electric Lamp Co., Ltd., Siemens Bros. Dynamo Works Co., Ltd.

In connection with the electrification of the Lea Bridge Road the Highways Committee has recommended that for certain other work beyond that already provided for, the existing contracts with the following firms be extended:—

Dick, Kerr & Co., Ltd.—Overhead equipment.
Reid Bros.—Duct laying.
Johnson & Phillips, Ltd.—Switchgear.
British Insulated and Helsby Cables, Ltd.—Low-tension cables.

L.C.C. — A 2-cwt. electrically-driven power hammer is to be provided at a cost of £250 in order to carry out certain repair work at the Greenwich generating station.

Arc lamp raising and lowering gear is to be fitted to the lamps in the tramway car-sheds at a cost of £200.

Luton.—The T.C. has accepted the tender of Messrs. Macintosh & Co., Ltd., of London, for a year's supply of insulated cables.

Portsmouth.—The T.C. has accepted the following tenders:—

Section rails and fish-plates.—Dick, Kerr & Co., Ltd.
Tie-bars.—C. Richards & Sons.
Twin cable.—Henley's Telegraph Works Co.
Arc lamp carbons.—Oliver Arc Lamp, Ltd.

Plymouth.—The T.C. is to enter into a fresh contract with the Tudor Accumulator Co., Ltd., at £280 per annum for 10 years for the maintenance of the batteries at the Prince Rock station and at the Armada Street sub-station. The agreement may be terminated in five years in the event of the Council desiring to dispense with the batteries at Prince Rock. The combined sums now paid for maintenance amount to £319 per annum.

South Australia.—Adelaide.—According to *Australasian Hardware and Machinery*, Messrs. Wm. Adams & Co., Ltd., have secured the contract for the supply of the electric generating plant and high-tension switchboard to the Municipal Tramway Trust, Adelaide. The electric plant will be manufactured by Messrs. C. A. Parsons & Co., and the switchboard by Messrs. Reyrolle. The plant will consist of three units of 1,500 kw., each capable of giving 2,250 kw. as a maximum, and at 11,000 volts. Condensers will also be supplied by Messrs. Parsons. "This is one of the largest electric contracts so far let in Australia."

Stretford.—The U.D.C. has accepted the tender of Ashley & Damville for the annual supply of slack for the generating station, at 7s. 7d. per ton. It has further accepted offers of the British Westinghouse Co. and the Oliver Co. each to supply on approval a set of 10 arc lamps for six months.

Walsall.—For the T.C. Tramways Department the following tenders have been accepted for annual supplies of stores:—

British Thomson-Houston Co., Ltd.—Armature coils, mica cones and collars, and commutator segments.
Siemens Bros. & Co., Ltd.—Linen frame tape and linen tape.
Henley's Telegraph Works Co., Ltd.—B. & P. tape and Blackley tape.
British Insulated and Helsby Cables, Ltd.—Mechanical ears.
Edison & Swan United Electric Co., Ltd.—Lamps.
National Rail and Tramway Appliances Co., Ltd.—Brake blocks.

Wolverhampton.—The Corporation has accepted the tender of Messrs. Hadfield's Steel Foundry Co. for the renewal of points in Queen Square, at £279 10s.; and of the Electric Apparatus Co. for electric meters (less allowance for old meters) amounting to £114.

FORTHCOMING EVENTS.

North-East Coast Institution of Engineers and Shipbuilders.—Friday, December 17th. At 7.30 p.m. At the Lit. and Phil. Society, Newcastle. Resumption of discussion on Mr. D. Myles's paper on "Some Notes on Marine Boiler Design."

Electro-Harmonic Society.—Friday, December 17th. At 8 p.m. At the Holborn Restaurant. Smoking Concert.

Northampton Institute Engineering Society.—Friday, December 17th. At 5.45 p.m. Debate on "Electric Traction *v.* Steam Traction."

Institution of Electrical Engineers (Manchester Students' Section).—Tuesday, December 21st. At the Municipal School of Technology, Manchester. Debate on "D.C. *v.* A.C. for Railway Traction." Mr. J. S. Peck in the chair.

Institution of Civil Engineers.—Tuesday, December 21st. At 8 p.m. Further discussion on Mr. C. W. Hodson's paper on "Railway Signalling in India," and a paper on "The Design of Rolling Stock for Smooth-rail Working on Heavy Gradients," by Mr. F. W. Bach.

THE ELECTRICAL ENGINEERS
(LONDON DIVISION).

The following orders are issued:—

Commanding Officer—Col. R. E. B. Crompton, C.B.

Monday, December 20th.—"A" Company. Technical drill, 7 to 9.30 p.m.

Tuesday, December 21st.—"B" Company. Technical drill, 7 to 9.30 p.m.

Wednesday, December 22nd.—Gymnasium, 6.30 to 9.30 p.m.

Headquarters will be closed from December 23rd, 1909 to January 2nd, 1910, inclusive.

(Signed) P. H. Campbell Capt. R.E. and Adjutant.
For O.C. E.E., L.D.

NOTES.

The Constantinople Telephone Concession.—A Constantinople correspondent of a German newspaper draws attention to what he terms the peculiar methods of the Turkish Government in regard to the allocation of the telephone concession for the Turkish capital, for which 16 offers were submitted. A commission composed of high technical and various Government officials was appointed by the Ministerial Council to examine the tenders, and they selected five out of the 16 as representing competitors who alone could come into consideration as being worthy of confidence in the carrying out of such an undertaking. On a close examination of the tenders the commission adopted the system of giving a mark to each group of competitors for every compliance with the conditions contained in the specification. One of the conditions provided that the competitors must submit proof of having already constructed large telephone installations of the extent contemplated in Constantinople. It was found that the most marks for the fulfilment of this condition were possessed by the Anglo-French-American group as represented by the Western Electric Co., of Chicago, the National Telephone Co., of London, the British Insulated & Helsby, Ltd., of London, and the Société Française Thomson-Houston, of Paris, and the Commission, therefore, expressed themselves in favour of the concession being granted to this group. As the group contains one of the oldest contractors for telephone installations, it was not surprising that the firm was able to maintain the record for the number of undertakings carried out. But in the opinion of the correspondent, this circumstance does not exclude the possibility that a more youthful company could execute the work better and under more favourable conditions than an old firm; and he remarks that such a case exists in this instance. Among the competitors the Commission placed in the second position the Ost Europaische Telegraphen Gesellschaft, which is a German undertaking. The technical members of the Commission even put the German company first on the ground that the offer was technically the best, and the correspondent learns that in another respect the company made a more favourable offer to the Government than the Anglo-French-American group. For instance, the company had recognised without further ceremony all the conditions in the specification, and had proposed in connection with the ultimate right of repurchase by the Government that a joint commission of members of the Government and the company should estimate the value of the installations, and thus fix the purchase price. On the other hand, the Anglo-French-American group changed the regulation in the sense that the purchase price should be represented by the value at which the installations stood in the company's books at the time of the repurchase. If, notwithstanding the more favourable offer of the German company, the Commission have awarded the concession to the triple group, the correspondent observes that other influences, political or otherwise, have been at work in the matter; and the German company has lodged a protest with the Turkish Government. But the question seems to be taking a much more unpleasant turn, as the Minister of Finance proposes to have a fresh specification prepared on the basis of the five close tenders, and to offer this solely to the Anglo-French-American group for acceptance or refusal. In the latter event, it is stated in conclusion, the new specification will then be offered to the other competitors in succession—a process which the correspondent severely condemns.

The Aluminium Situation.—According to a communication published from trade circles in the *Frankfurter Zeitung*, the hopes of an understanding among the French producers of aluminium, after months of preparatory work, had to be abandoned at the beginning of October. The inland understanding between the French firms, who produce as much as all other works combined, would naturally have formed the basis for a far-reaching combination. But from the beginning the allotment question or the regulation of the output of the individual works seems to have been incapable of solution. It is quite obvious that the powerful undertakings which during the period of high prosperity carried out what were doubtless exaggerated extensions, now object to renounce their comprehensive schemes in relation to production. Nevertheless, they will find themselves, if they also wish to improve the price of the metal, in the situation which they themselves created through the excessive straining of the (late) syndicate prices. The price of aluminium improved from the time of the appearance of the first syndicate rumour in June, 1908, but since the definite abandonment of this community of interests in October, consumers have manifested a natural reserve. This circumstance is aggravated by the accumulating offers of intermediaries who seem, owing to the continued circulation of syndicate rumours, to have supplied themselves with large quantities at the lower prices prevailing until recently. But as their speculative purchases were not so quickly realised as they had hoped for, they are inundating the market with cheap prices which again appear at about 1s. 3d. per kilogramme and lower for crude aluminium. Apart from this, consumers are deriving advantage from the situation. There is no doubt that the consumption of the metal is increasing, and must in all probability continue to progress if the price is kept within normal limits. These may be regarded as from 1s. 5d. to 1s. 7½d. per kilogramme for crude ingots or plates, with an extra of from 5d. to 5½d. for the rolling-out of sheets. On the basis of this charge for sheets, the manufacture of aluminium vessels and various articles is remunerative, but the overstepping of this maximum would reduce the consumption. In conclusion, it is stated that the present average price of 1s. 3d. per kilogramme for crude aluminium only represents a small profit, but it no longer directly results in a loss.

What is "Annual Horse-power?"—The Niagara Falls Park Commission recently sued the Canadian Niagara Power Co. for some £3,000 rental for excess power generated at the company's power house during the years 1905-8; the judge held that the "actual power"—by which is clearly meant the *energy* used, for it was defined as rate multiplied by time—was to govern the rental, and not merely the rate alone. The Commission, according to the *Electrical World*, has now applied for a rehearing of the case, contending that in the case of electricity a rate can be sold—the rate of doing work. The question is, in fact, whether the maximum demand shall control the rental, or the total energy supplied. In the case of a water-power plant, of course, the former may be a vastly more important matter than the latter. The dispute has probably arisen from the too common tendency to speak of power or current when one really means electrical energy; an agreement properly drawn up by a man who had a clear understanding of the fundamental distinction between the two could not lead to this confusion. The case is probably being heard this week, and may ultimately reach the Privy Council.

Note this Statement.—A Canadian correspondent, writing under this heading, says: "Within a radius of 8 miles of Ottawa are 200,000 electric H.P., and within a radius of 55 miles the amount is estimated at 917,403 H.P. Of this amount only 58,400 H.P. is in use, leaving 859,003 H.P. available. What an industrial centre Ottawa should be!"

Football.—L.C.C. Sub-stations Football Club.—On Wednesday last a football match took place at Herne Hill, between the Southern and Northern Sub-stations of the L.C.C. Tramways. The president of the Southern Section Club, Mr. E. L. Pope, kicked off at 3 p.m. before a large and enthusiastic audience, and after an exciting and well-fought game the result was a win for the Southern Section by 4 goals to 1.

Electric Time Service.—Portsmouth T.C. will take £300 from the reserve fund for the purpose of installing an electric time service

Electric Shock Fatalities.—A miner, engaged as a "brusher" in the Dechmont Colliery, No. 1, Cambuslang, accidentally came in contact with an electric lamp, and expired almost immediately. A joiner was killed in the Rolled Steel Forge Co.'s works, Wishaw. Along with others he was engaged in lifting a steel plate on to an iron table. A chain sling was fixed round a wooden beam, along which ran the electric wire which is used for lighting the workshop, and which carried current at about 230 volts. The sling came in contact with the live wire, which charged the sling that was being held by the unfortunate man, who was thus killed.

Appointments Vacant.—The L.C.C. is going to appoint a switchboard attendant to be employed in the chief engineer's department at Hungerford House, at 35s. per week for six months. Associate Head of the Department of Electrical Engineering and Applied Physics at Northampton Polytechnic Institute (£400). The Ilford U.D.C. is wanting a tramway manager at £300 per annum. See our "Official Notices" to-day.

Architects and Specialised Branches.—In the course of a discussion at the Royal Institute of British Architects on Monday night, on "Architectural Education in America," Mr. T. J. Jackson, R.A., said that when he had problems of heating and ventilating and electric lighting to carry out in connection with a building he called in an expert, and he thought the architect was a wise man who did this, for it was impossible for one man to know everything. Mr. H. H. Statham agreed with Mr. Jackson that it was well to get the assistance of specialists in such matters, but thought architects ought to know the general principles underlying all matters connected with the erection and equipment of a house.

Metropolitan Association of Electric Tramway Managers.—The members of this Association held a meeting on Friday, the 10th inst., at the Municipal and County Club, Whitehall, S.W., those in attendance being Sir Clifton Robinson (London United Tramways), Messrs Blain (West Ham), Howard (Barking), Coveney (Erith), Mittelhausen (Bexley), Ulimann (East Ham), Schofield (Leyton), Hammond (Metropolitan Electric), Mason (South Metropolitan), and Goodyer (Croydon), hon. secretary. Apologies for absence were received from Messrs. Bruce (L.C.C.), Balfour (Dartford), and Murray (Walthamstow). Sir Clifton Robinson was unanimously elected chairman of the Association and Mr. Goodyer was re-elected hon. secretary. Various matters relating to Metropolitan tramway interests were discussed.

Canadian Electric Steel.—Referring to the Electric Steel Co.'s experimental plant, previously mentioned, the *Electrical World* says that it is expected that by 1912 about $15,000,000 will have been invested in the company's plant and works. It is reported that there are a dozen very wealthy persons interested in the enterprise.

Electro-Harmonic Society.—A smoking concert is to be held in the King's Hall, Holborn Restaurant, to-night at 8 o'clock. The artistes include the following:—Messrs. Harold Wilde and William Forington; Mr. Joe Morley (Banjo Solos); Mr. Nelson Hardy (ventriloquial sketches); Mr. Will Edwards (humorous songs); Mr. Harold Montague (humorous sketches); and Mr. Robert Ganthony (humorous sketches).

Copper.—The present hardening of the Copper Market is evidence of cheerfulness on the part of the "bulls" and incredulity as to the imperfections in the completeness of the copper combine, which have occasionally been surmised. The *Financial News*, in an article of December 7th, calls attention to another important factor in the situation—viz, the decision of the U.S. Courts as to the legality of the Standard Oil Trust. "The significance," says the writer, "of the decision, should it be finally confirmed by the Supreme Court, to which it will be promptly referred, is that it will bring in question the large number of other industrial corporations that are already operating on much the same lines . . . . not to mention the new companies that are in preparation." It is pointed out, however, that in a previous case the Supreme Court refused to confirm a decision of a District Court against the Standard Oil Co., and that this may possibly happen again. Naturally, if the decision should be adverse to the Trusts, the effect on the market, at any rate for the time being, will be considerable. Curiously enough, the *Financial News* article notes, the Budget is also extending its influence over the situation. It is surmised in American financial circles that a failure to compromise must result in extensive borrowing, which will sweep up the investable money available.

Northampton Polytechnic Institute.—The annual distribution of prizes took place at this Institute in Clerkenwell on Friday evening last, the conversazione of the members and students being held on the following evening as usual. On Friday the distribution was performed by Sir John Wolfe Barry, who delivered an interesting address, in which he alluded, among other things, to the educational and social influence of such institutions as the Northampton. In the course of his report to the assembly, the popular principal, Dr. R. Mullineux Walmsley, referred to the important decision of the L.C.C. to make a special grant of £5,600 for the establishment of an electric light and power generating station. This would afford excellent opportunities for the senior students. Aeronautical engineering is also now among the subjects taught at this Institute.

International Conference on Electrical Units and Standards, 1908.—A Blue Book has been issued containing an Appendix to the Report of the Conference, consisting of notes on the methods adopted in various standardising laboratories, to realise the international ohm and ampere, and to prepare the Weston Normal cell. While the methods described fall within the general international specifications, the details of the procedure differ; the various methods, however, give very nearly identical results. The bulk of the matter relates to the procedure followed at the official laboratories of the United States, France, Germany and Great Britain, in the preparation of the Weston Normal cell.

National Industrial Education League.—A proposal is on foot to establish a League with the foregoing title, for the purpose of giving boys, before they leave school, a sound elementary industrial training. Mr. R. Applegarth, of 23, Parchmore Road, Thornton Heath, is the organiser, and has already obtained a very large and influental body of supporters, including 57 Trades Councils. The central offices are at Craig's Court House, Charing Cross, S.W.

Institution and Lecture Notes.—Institution of Electrical Engineers.—At the meeting held in London last week there was a discussion on the state of the electrical industry, in which Messrs. Garcke, W. Rutherford, S. P. Thompson, J. S. Raworth, A. A. Campbell Swinton, W. M. Mordey and Theodore Rich took part. Our report will appear next week, together with the concluding part of the paper.

Institution of Electrical Engineers (Glasgow).—Members of the Glasgow Local Section, I.E.E., held their eighth annual dinner in the Grosvenor Restaurant, Glasgow, on the evening of December 1st. Mr. E. George Tidd, chairman of the Section, presided over an attendance of 248, and Messrs. W. W. Lackie, W. M'Whirter, and H. A. Mavor were croupiers. The Lord Justice Clerk proposed "The Corporation of Glasgow." Bailie Archibald Campbell, who responded, said the electricity department was one of the most prosperous they had. They owed the success of the electricity department to the fact that they had been fortunate in the men at the head of it—Mr. Chamen, who was their chief engineer for a number of years, and his successor, Mr. Lackie. They had now some 65,000 H.P. at their electricity works, and the results of their operations from the financial point of view had been most satisfactory. Prof. Archibald Barr proposed "The Institution of Electrical Engineers." Dr. Kapp replied, and said that while electrical engineers had conferred many benefits on mankind, they must be on their guard against trying to do too much with electricity. If anybody, for instance, tried to smelt iron ore by electricity, he would find his pig-iron very dear, and like many who benefited others, the electrical engineer did not get much good himself from the benefits he conferred. Electricity was the servant and helpmate of all other industries, more especially of the younger industries. They heard a great deal about the foreign advances in electricity, but in other countries there were a greater number of young industries. The progress of electrical science was controlled by what might be called intellectual tides. To-day it was a race for progress between us and America, and meantime we were leading. This cry about our being backward mostly emanated from the Cassandras who controlled the electrical Press. It was a case of continual advancement, now in this country, now in that. He had recently visited the steel works of Hickman, Ltd.; the rolling mills there were driven by a set of continuous-current motors with the usual polyphase dynamos, and that installation was as perfect as anything that could be made. All that stuff was made in England by the Electric Construction Co., and no doubt many other firms could do equally good work. The Lord Bishop of Glasgow proposed "The Glasgow Local Section of the I.E.E.," which during the last 10 years had doubled its numbers. The chairman, in reply, said that during the fog which had recently been over the city, the electrical pressure had been maintained up to the standard. A vocal and musical programme was given throughout the evening.

Northampton Institute Engineering Society.—In the programme of this Society the following papers and visits are announced:—

December 17th.—Discussion on "Electric Traction *v.* Steam."
January 21st.—"Choice of Prime Movers for Power Stations," by E. T. Driver.
February 4th.—"History and Manufacture of Electric Glow Lamps," by L. Wallis.
February 18th.—"Hydraulic Presses," by H. Webb.
March 4th.—"D.C. Liquid Starters."
March 18th.—"Oxidation of Atmospheric Nitrogen in the Electric Arc," by Mr. S. Field.

Visits.

January 21st.—Board of Trade Laboratory, Whitehall.
February 12th.—Lot's Road Power Station.
February 25th.—Western Electric Co.
March 5th.—Robertson's Lamp Works.
March 19th.—National Physics Laboratory.

Institution of Civil Engineers (Students).—At the meeting on December 3rd, Mr. George Ingram, Stud.Inst.C.E., read a paper on "The Design of Generating Stations," describing a suggested arrangement of plant for a shipyard, and for a large high-tension alternating current station suitable for a bulk supply scheme.

Iron and Steel Institute.—A scholarship entitled the "Andrew Carnegie Research Scholarship," will be awarded annually to a selected candidate, or candidates, for the purpose of conducting researches in the metallurgy of iron and steel and allied subjects. Application should be made to the secretary before the end of February.

King's College (University of London).—Special courses of lectures will be delivered on "Irrigation Works" (commencing January 13th), "Reinforced Concrete" (January 19th), and "Single-phase Electrical Traction" (January 17th), the last-named by Prof. Ernest Wilson and Mr. Francis Lydall.

Physical Society of London.—The fifth annual exhibition of electrical, optical and physical apparatus—mainly electrical—was held at the Imperial College of Science on Tuesday last. There was a very interesting collection on view, though there were, perhaps, not quite so many novel features as last year. It is a pity that the duration of the exhibition is so short—it is impossible to do justice to the apparatus shown in the time available; but doubtless the objections to extending the time are very great. We shall illustrate and describe a number of the exhibits in later issues.

Ordnance Athletic Club.—A smoking concert was held on December 14th at the King Edward VII, New Corporation Street, Birmingham, in connection with the Football Section (Second Division) Works League of this club, between 300 and 400 of the staff and workpeople being present. The chairman, Mr. J. R. Garner (works manager), read a letter of apology from the superintendent of works and president of the "Ordnance" A.C., Mr. F. E. Hinton, who regretted his inability to preside, but wished the club every success, he being strongly in favour of sports. He considered they were most essential to workers shut up in a factory all day long, and he trusted during the forthcoming season that the cup put up for competition by Messrs. Vickers, Sons and Maxim, Ltd., Sheffield, the parent company, would again come back to Birmingham. This cup was won the first year of competition, 1908, by the Ordnance Athletic Club, against teams from the works of Vickers, Sons & Maxim, at Barrow, Sheffield and Erith, and the Wolseley Motor-Car Works, Birmingham. The chairman heartily confirmed the president's sentiments, and stated that a firm who had a first-class athletic club, were invariably a successful business concern, a good player was usually a good worker. Mr. Morrison, the secretary and commercial manager of the company, was in the vice-chair. Mr. Williams, assistant works manager, proposed a vote of thanks to the chairman, which was seconded by Mr. Partridge, secretary of the Entertainments Committee. A toast was proposed by Mr. Alexander, who coupled the Works Football Association, together with the artistes. Mr. E. M. Mitton, the chairman of the Football Association, Birmingham works, responded. A very enjoyable programme was given.

Marvels of Electricity.—The *Daily Mail* has lately been greatly excited over a report that Herr Ruhmer has succeeded in transmitting the likeness of inanimate objects by telegraph—"Seeing by Wire." That this feat is conceivable has long been well-known; the enormous cost of the feat is also well-known. If any millionaire cares to devote a quarter of a million sterling to its achievement, we have no doubt that success will be attained—though we doubt whether any useful purpose will be served thereby. Our contemporary, however, finds quite a lot to say about what may happen—in the future.

Wireless telephony from Paris to New York has formed another subject for the *Daily Mail's* imagination to work upon. We are assured that in a few weeks it may be possible to speak across the Atlantic—over 3,500 miles. Nay, in a leading article we are informed that it is "on the eve of fulfilment!" We have no wish to be a wet blanket, but we think it would be well to talk efficiently over, say, 500 miles before asserting so confidently that seven times that distance will shortly be covered. The transmission of power through space, as the solution of the aerial navigation problem, forms a fitting wind-up to the leader referred to.

Damages for Personal Injury.—In the King's Bench Division on Wednesday, at a trial before Mr. Justice Ridley and a special jury, Mr. T. A. Kerr was awarded £150 damages against Messrs. T. Tilling, Ltd., for personal injuries. The plaintiff was alighting from an electric tramcar in Camberwell when he was knocked down by one of the defendants' omnibuses passing on the near side. The judge having left the building when the verdict was announced, judgment was not entered.

German Patent Cancelled.—We are informed by the Regina Arc Lamp Works, Cologne, that in consequence of proceedings taken by the German Beck Arc Lamp Co. for infringement in respect of the former company's "Conta" lamp (described in our issue of November 5th, p. 751), the Regina Arc Lamp Co. has sought and obtained the cancellation of the Beck Co.'s German patent relating to the support of the negative carbon in flame arc lamps.

Plant for Sale.—The Brighouse Corporation is offering for sale a couple of Crossley gas engines and dynamos, a booster, switchboard, &c. Particulars will be found among our advertisements to-day.

Efficiency of Turbines.—Too late for our "Correspondence" columns, the A.E.G. Electric Co., Ltd., write us with reference to their letter of the 1st ult., published in our issue of November 5th (page 732) pointing out that an error appears to have crept into diagram fig. 1, in which the Witkowitz A.E.G. turbine is given as one of 3,000 kw., while the letterpress gives the output as 2,000 kw. In point of fact, this machine was of 2,000 kw. output, and the features that they wished to bring out in the diagram were (1) that the 2,000-kw. A.E.G. turbine had the same efficiency as the 3,000-kw. A.E.G. machine; and (2) that both the 2,000-kw. and 3,000-kw. A.E.G. turbines showed a better efficiency with a 91·7 per cent. vacuum than the 2,000-kw. Willans-Parsons turbine.

OUR PERSONAL COLUMN.

The Editors invite electrical engineers, whether connected with the technical or the commercial side of the profession and industry, also electric tramway and railway officials, to keep readers of the Electrical Review *posted as to their movements.*

Central Station Officials.—The Luton T.C. has increased the salary of Mr. H. A. Kell, chief assistant at the Electricity Works, from £117 to £140 per annum.

The Fareham U.D.C. has appointed Mr. Rowland Stanley Jull as assistant engineer at the new electricity works.

A staff presentation was made to Mr. W. D. Morgan, late managing engineer of the Coatbridge and Airdrie Electric Supply Co., Ltd.—at a smoking concert held in the Eagle Hotel, Coatbridge, on Friday last. Bailie Neilson, the local chairman of the company, presided, and the presentation was made by Captain Arthur, one of the directors.

Mr. F. J. Launchbury has been appointed "Resident Engineer" to the Coatbridge and Airdrie Electric Supply Co., Ltd.

General.—Nobel Prizes.—The Nobel Prize for Physics this year has been divided between Mr. G. Marconi, for his work in wireless telegraphy, and Prof. Karl Braun, whose scientific discoveries also include research in wireless telegraphy. The Chemistry prize has been awarded to Prof. W. Ostwald, one of the leading investigators in the field of electro-physics. Each of the Nobel prizes this year is worth £7,734.

Mr. A. J. E. Catto, formerly in the service of the British Westinghouse Electrical and Manufacturing Co., Ltd., and lately trading in partnership as John Price & Co., Handsworth, Birmingham, has arranged to go to Montreal, per *Corsican*, on 17th inst., to enter the employ of Messrs. Allis-Chalmers, Bullock, Ltd., of that city.

Mr. Edward G. C. Barton has resigned his position as managing director of the City Electric Light Co., Ltd., Brisbane, Queensland, and has been appointed consulting engineer, thus maintaining his connection with the company while securing liberty to engage in private consulting practice. According to an Australian exchange he has taken an office in the New Zealand Insurance Co.'s building in Queen Street, Brisbane.

Obituary.—Dr. Ludwig Mond.—This world-renowned chemist passed away at his London residence on Saturday morning last. Born in Germany in 1839 he came to England in 1862, and straightway turned his training as a chemist to good account. He settled definitely in this country in 1867, and in 1873, in conjunction with Mr. (now Sir) John Brunner, he established the great firm of Brunner, Mond & Co., of Northwich, whose alkali manufactory is now the largest in the world, and whose commercial success is the envy of all. His brain was most fertile in producing inventions in various branches of applied chemistry. In the course of an appreciative review of his life in the *Morning Post*, a writer says:—"From an early period in his career he directed his attention to the great problems of the economical consumption of coal, and of the recovery of ammonia from nitrogenous products of coal distillation. Subsequent to 1883 he took out a number of datents for appliances, which combine those two problems by utilising the coal in the form of gas, and recovering at the same time the nitrogen contained in it in the form of ammonia. The outcome of his work in that direction formed the subject in 1889 of his presidential address to the Society of Chemical Industry. Dr. Mond afterwards gave particular attention to the use of the gas produced by his methods for the direct production of power by means of gas engines, and to the utilisation of the large amount of heat that had hitherto been lost in hot exhaust gases from such engines. With the view of utilising the gas obtained by him from coal for the direct production of electricity, Dr. Mond worked out in conjunction with his assistant, Dr. Carl Langer, a new form of gas battery, which he described to the Royal Society in 1889. What is known as 'Mond gas' is now extensively employed in industry." Some 13 years ago Dr. Mond founded and endowed the Davy-Faraday Research Laboratory at the Royal Institution. He was most generous in his support of scientific research and scientific institutions, and to the latter he, of course, made very many important contributions in the form of papers.

Mr. Edward Tangye.—The death is recorded, in his 78th year, of Mr. Edward Tangye, one of five brothers who built up the well-known Birmingham engineering business of Tangye's Ltd. Mr. Tangye was no figure-head director; he took, in his early years, a very active interest in the mechanical engineering department, and in his later years, when ill-health kept him away from the works, his practical efforts in the business did not flag, for he continued to devote a real interest to the design and construction of automatic machinery. To our mind, English engineering owes much of its past and present greatness and success to the fact that such men—men who know their business well—have with their own hands and heads built up big undertakings from small things. Infinitely better thus than to have boards of directors and figure-head chairmen who, well as they may know finance or the manner of the board-room, not being practically experienced, have not heart and soul in the concern over whose destinies they preside in the interests of shareholders.

Mr. H. V. Cowell, traffic superintendent of the New St. Helens and District Tramways Co., died at his residence, St. Helens, on Saturday, after a few days' illness, aged 32 years.

TRADE STATISTICS OF HOLLAND.

The following figures, showing the imports of various goods into Holland in 1908, are taken from the recently issued annual trade statistics; the figures for 1907 are added for purposes of comparison, and notes of any increases or decreases are given :—

	1907. Gulden.	1908. Gulden.	Increase or decrease. Gulden.
Machinery, steam, industrial and agricultural.—			
From Belgium	2,364,000	2,208,000	— 156,000
„ Great Britain ...	6,233,000	6,626,000	+ 393,000
„ Hamburg	160,000	141,000	— 19,000
„ Germany	13,139,000	14,178,000	+ 1,039,000
„ United States ...	3,276,000	3,934,000	+ 658,000
„ Other countries ...	241,000	273,000	+ 32,000
Total ...	25,413,000	27,360,000	+ 1,947,000
Gutta-percha, raw.—			
From France	1,422,000	758,000	— 664,000
„ Great Britain ...	38,000	21,000	— 17,000
„ Dutch Guiana ...	451,000	573,000	+ 122,000
„ Java	3,085,000	1,328,000	— 1,757,000
„ Other countries ...	184,000	132,000	— 52,000
Total ...	5,180,000	2,812,000	— 2,368,000
Gutta-percha manufactures.—			
From Belgium	549,000	499,000	— 50,000
„ Great Britain ...	297,000	366,000	+ 69,000
„ Germany	250,000	282,000	+ 32,000
„ Other countries ...	36,000	6,000	— 30,000
Total ...	1,132,000	1,153,000	+ 21,000
Iron wire.—			
From Belgium	709,000	1,584,000	+ 875,000
„ Great Britain ...	37,000	20,000	— 17,000
„ Germany	17,406,000	20,912,000	+ 3,506,000
„ United States ...	1,000	44,000	+ 43,000
„ Sweden	277,000	216,000	— 61,000
Total ...	18,430,000	22,776,000	+ 4,346,000
Instruments, physical, chemical, &c.—			
From Belgium	562,000	534,000	— 28,000
„ Great Britain ...	380,000	306,000	— 74,000
„ Hamburg	190,000	76,000	— 114,000
„ Germany	3,724,000	3,825,000	+ 101,000
„ Other countries ...	141,000	96,000	— 45,000
Total ...	4,997,000	4,837,000	— 160,000
Copper wire.—			
From Belgium	146,000	271,000	+ 125,000
„ Great Britain ...	77,000	83,000	+ 6,000
„ Hamburg	272,000	26,000	— 246,000
„ Germany	2,709,000	3,067,000	+ 358,000
„ Other countries ...	5,000	8,000	+ 3,000
Total ...	3,209,000	3,455,000	+ 246,000
Steel wire.—			
From Belgium	4,040,000	1,718,000	— 2,322,000
„ Great Britain ...	591,000	495,000	— 96,000
„ Germany	8,300,000	4,865,000	— 3,435,000
„ Other countries ...	31,000	8,000	— 23,000
Total ...	12,962,000	7,086,000	— 5,876,000
India-rubber manufactures.—			
From Belgium	277,000	309,000	+ 32,000
„ Great Britain ...	1,212,000	1,455,000	+ 243,000
„ Germany	1,029,000	964,000	— 65,000
„ United States ...	6,000	11,000	+ 5,000
„ Other countries ...	30,000	17,000	— 13,000
Total ...	2,554,000	2,756,000	+ 202,000
Glass manufactures.—			
From Belgium	266,000	254,000	— 12,000
„ Great Britain ...	120,000	89,000	— 31,000
„ Germany	1,539,000	1,467,000	— 72,000
„ Other countries ...	13,000	7,000	— 6,000
Total ...	1,938,000	1,817,000	— 121,000
Porcelain.—			
From Belgium	175,000	145,000	— 30,000
„ Great Britain ...	57,000	51,000	— 6,000
„ Germany	1,059,000	947,000	— 112,000
„ Other countries ...	68,000	51,000	— 17,000
Total ...	1,359,000	1,194,000	— 165,000

N.B.—Gulden = 1s. 8d.

OFFICIAL RETURNS OF ELECTRICAL COMPANIES.

W. Sisson & Co., Ltd. (82,295).—This company's annual return was filed on November 12th, when 3,225 preference, 11,601 ordinary and 7,000 deferred shares had been taken up out of a nominal capital of £25,000 in 5,000 preference, 13,000 ordinary and 7,000 deferred shares of £1 each. £9,376 paid. £12,450 considered as paid. Mortgages and charges: Bank overdraft—limit £5,000, actual amount £4,530 2s. 3d.

Electro-Mechanical Brake Co., Ltd. (98,276).—A memorandum of satisfaction in full on November 20th of charges dated May 4th and June 9th, 1909, securing £490, has been filed.

Monte Video Telephone Co., Ltd. (27,208).—This company's annual return was filed on November 17th, when 86,492 preference and 72,680 ordinary shares had been taken up out of a nominal capital of £160,000 in £1 shares (87,000 preferred and 73,000 ordinary). £159,172 is considered as paid. Mortgages and charges: Nil.

Pacific and European Telegraph Co., Ltd. (36,683).—This company's annual return, made up to November 9th, has been filed. The entire capital of £100,000 in £10 shares has been taken up. £4 per share has been called up. £40,000 has been paid. Mortgages and charges: £99,400.

CITY NOTES.

West Kootenay Power and Light Co., Ltd.

The annual report for the year ending August 31st, 1909, states that, having regard to the conditions that have existed in the copper and other mining industries during the year, the result to the company is considered highly satisfactory. The gross revenue from all sources amounted to $300,954, from which must be deducted the operating expenses, maintenance and keep-up of every nature $96,773, leaving a net revenue of $204,181. The interest on the outstanding bonds and the bonds redeemed by the sinking fund as provided in the mortgage absorbed $104,405, leaving a surplus for the year available for dividends of $99,776. Dividends have been paid during the year amounting to $59,500, leaving a balance to be added to profit and loss account of $40,276. The amount to the credit of profit and loss account at the beginning of the year was $409,732, to which has been added the balance as above—$40,276—making a total of $450,008.

In view of having available this large balance at the credit of profit and loss account, the directors have thought it advisable to write off at once, instead of over a period of years, the whole of the cost, expenses and discount in connection with the issue of $1,500,000 of bonds, the entire interest charge during construction of the new installation, instead of adding it to the cost of construction, a substantial and fully adequate amount for depreciation in addition to the sinking fund, and to make provision for all doubtful debts, absorbing in this way the sum of $325,000.

This still allows the sum of $125,007.86 to be carried forward to the credit of profit and loss account.

During the year, the president, in company with the general manager, has visited the plant, both at Bonnington and Cascade, as well as the sub-stations at Rossland, Grand Forks, Greenwood and Phœnix, and reports the plant in most excellent condition and in a high state of efficiency, reflecting great credit on the general manager and his staff.

The completion of transactions between this company and the Cascade Co., by which this company has taken over the property and rights of the Cascade Co., has been delayed by many difficulties, but all questions have now practically been settled.

In regard to the future, it may be stated that the present low price of metals makes it advisable not to expect any very large increase during the immediate ensuing year, but the directors have great confidence in the future development of the country and the prosperity of the company.

Prospectuses.—*The Rosario Electric Co., Ltd.*—The subscription list opened on Tuesday and was to close yesterday in an issue of 20,000 ordinary shares of £5 each at par. The purposes for which the money is required were described by the chairman at the recent meeting of the company (see Electrical Review, November 5th, 1909).

Sempah Rubber Estates, Ltd.—An issue of 60,000 shares of £1 in this company has been offered for subscription at par. The company is to acquire and develop the Sempah and Sungei Jawee Estates, in the district of Nebong Tebal, Straits Settlements. There are 100,000 trees planted, some of them having been put down in 1905, but nearly one-half in 1909.

Bujong Rubber Estate, Ltd.—This company has been issuing 26,000 shares of £1 each at par. It is to acquire the Bujong Rubber Estate, Mukin of Sungei Buloh, Selangor, F.M.S. (1,000 acres, of which 356 have been planted and 129 are now being opened).

Isle of Thanet Electric Tramways and Lighting Co., Ltd.—The directors' report for the year ended September 30th last shows a balance of £15,053, compared with £13,391 for the previous year. The undivided revenue for disposal is £7,851. After placing £3,000 to reserve, it is proposed to pay a dividend of 1¼ per cent. on the preference shares, absorbing £1,875, and leaving £2,976. £1,500 is to be appropriated towards future maintenance of permanent way, and £1,476 is to be carried forward. Capital expenditure incurred during the year amounted to £4,962, for additional power plant and machinery, and to £1,809 for extensions of lighting mains. The sale of electricity increased by £398, compared with the previous year, or nearly 10 per cent., and, with the additional plant now at their disposal, it is hoped to further increase the income of the company from this source.

R. Waygood & Co., Ltd.—A dividend of 6d. per share on the ordinary shares is announced.

India-Rubber, Gutta-Percha and Telegraph Works Co., Ltd.

Major Leonard Darwin presided on Tuesday at the annual general meeting held at 106, Cannon Street, E.C. In moving the adoption of the report (see Electrical Review, December 10th, page 947), he said that the shareholders might be congratulated on the showing they were able to make on this occasion. The year had been an anxious one for them all, as the ever-increasing cost of raw material had been a constant menace. The advances had been, however, so marked and of so steady a character, that purchasers of their goods had been able to appreciate the absolute justice of the increases in selling prices which they had made during the year. Although their turnover had been higher than last year, and by turnover they meant the cash obtained for their goods, yet this turnover did not necessarily mean that the bulk of their business had been greater. An increase in the selling price of goods always tended to a decrease in the bulk of any business, but when the selling prices fell, it did not follow that the bulk would immediately increase sufficiently to prevent a diminution in cash receipts, which might, therefore, become less. He did not wish to labour this point, but he thought it well to refer to it for the benefit of some of the shareholders who had not an intimate knowledge of manufactured goods. Some of their foreign agencies had not done so well as they had reason to expect. To a certain extent this was due to their markets, which were situated at a distance, not responding so quickly to the changing conditions as their home agencies were able to do. They had been obliged to give up their warehouse and premises in Paris, where they had been for many years. This was due to their landlord requiring them for his own occupation. In selecting their new headquarters in France they had encountered considerable difficulty in getting exactly what they required at a reasonable rent in accommodation and in situation which they thought best suited their trade. Although the accommodation they had arranged for was quite sufficient for their purposes, yet they were not completely satisfied with the position. Their desire was to be efficient without extravagance. In the extension of their business they were making a new venture by opening a branch at Christchurch, New Zealand, and the agent who would have charge of it had just arrived at his destination and had secured the necessary premises. Their French works, which they had been slowly extending to meet the growth of trade, had in the last few years had a considerable amount of money spent on them, and they were now making a large expenditure in buildings and machinery to be prepared to supply the increased demand which they had expected for Palmer cord motor tires. In some lines of business at Silvertown they were suffering from a congestion which would doubtless require to be dealt with and would entail further expenditure. This question was having the most serious consideration of the board, but he did not now propose to lay before them any details on this subject, as their ideas for the present were quite immature. The raw rubber market, after touching a price of 9s. 2d. per lb. for the fine hard Para grade, had fallen away to 7s. 2d. per lb., but he did not care to venture a prediction of what was likely to be the position three months hence. In the report the board had made some provision for a possible fall in the selling prices of such of their stocks as might have been manufactured at a time when the standard price of the raw material was higher than at the date of realising their manufactured goods. The chairman then formally moved the adoption of the report and the distribution of a dividend of 5s. per share, or at the rate of 5 per cent. per annum, payable on the 1st prox. on the preference shares, and of a dividend of 15s. per share free of income-tax, payable on 16th inst., to the holders of ordinary shares.

Mr. R. Kaye Gray seconded the motion.

A shareholder said there was some talk in the daily Press some months ago about their intending to open a new factory. Was this still in contemplation?

The Chairman: That is really the point to which I alluded in my remarks—that further expenditure may become necessary at any moment to meet our growing trade. But at present we have come to no definite decision. The matter is, as I say, being most carefully considered by the board, and directly we come to any definite conclusion we shall let the shareholders know on the first available opportunity; but there is nothing at present decided. Our trade—especially, I think I may say, in bicycle tires—has been growing very rapidly, and it may be absolutely necessary, in the interests of the shareholders, to extend our premises; but at present we have made no final decision.

The motion was carried unanimously.

Major Darwin was re-elected as a director.

In responding to a vote of thanks to the board and staff, the Chairman reminded them that they had strengthened the board by adding two extraordinary directors, the two brothers Gray, and he might say that there was no one who knew the details of the working at the works better than those two gentlemen. Their addition to the board as extraordinary directors added strength to their deliberations.

Western Telegraph Co., Ltd.—The directors have declared a first quarterly interim dividend of 3s. per share, free of income-tax, for the year ending June 30th, 1910, being at the rate of 6 per cent. per annum.

Manx Electrical Railway Co., Ltd.—The directors have declared a dividend of 5½ per cent. on the preference shares.

Melbourne Electric Supply Co., Ltd.

The directors report that during the year ended August 31st, 1909, capital expenditure in Australia on additional land, buildings, plant and mains, &c., has been incurred as follows:—On the Melbourne undertaking, £22,807; on the Geelong undertaking, £1,745 = £24,552. The profit and loss account shows that the gross profit derived during the year from the Melbourne and Geelong undertakings was £23,013. Adding the dividend received on the company's holding of ordinary shares in the Adelaide Electric Supply Co., Ltd., together with discounts, transfer fees, &c., the total gross profit for the year amounted to £29,733, which compares with £22,030 for the previous year. Management and general expenses at the London head office absorbed £2,045, and interest on debenture stock and sundry loans amounted to £14,218. After payment of these charges, there remains a balance to the credit of profit and loss of £13,470, to which must be added the amount of £1,772 brought forward from the previous year, making a total credit balance of £15,242. Of this sum the directors have applied amounts of £979, £504 and £1,037 in writing off the special charges, expenses, and losses, as shown in detail in the profit and loss account, leaving an available balance of £12,722, which the directors recommend should be applied as follows:—Dividend on 20,000 7 per cent. first preference shares to August 31st, 1909, paid on September 1st, 1909, £1,821; transfer to depreciation and general reserve account, £5,124; writing down suspense account, £2,039; writing down head office furniture, £43; leaving a balance to carry forward of £3,694 = £12,722. In order to pay off loans from the company's bankers and others, and to make provision for future necessary expenditure, the capital account of the company has been readjusted during the past year. With the consent of the debenture stock and share holders, an issue of a further £100,000 5 per cent. first mortgage debenture stock, and of £100,000 7 per cent. first cumulative preference shares of £5 each, ranking in priority to the existing £150,000 6 per cent. cumulative preference stock, was made in May last. Out of the proceeds of this issue all outstanding loans have been paid off. Simultaneously the 30,000 6 per cent. cumulative preference shares of £5 each were converted into £150,000 6 per cent. cumulative stock. The board have under consideration proposals for dealing with the arrears of dividend on this stock, amounting at August 31st, 1909, to £71,950. The following table shows the progress made by the Melbourne and Geelong undertakings:—

Date.	Lighting in 30-watt lamps.	Motors in rated H.P.	Total equivalent connections expressed in 30-watt lamps.	Total units sold.	Gross profit.
Melbourne.					
August 31st, 1907 ..	76,278	1,553 H.P.	125,974	1,820,879	£14,290
August 31st, 1908 ..	90,088	2,150 H.P.	157,412	2,826,307	£16,063
August 31st, 1909 ..	104,900	2,434 H.P.	182,788	2,716,174	£20,573
Geelong.					
August 31st, 1907 ..	22,150	701 H.P.	44,582	344,501	£2,064
August 31st, 1908 ..	26,942	818 H.P.	51,864	312,661	£1,623
August 31st, 1909 ..	28,336	893 H.P.	56,920	364,770	£2,439

Further illustration of the growth of the Melbourne undertaking is afforded by the curves given in the report. It will be seen from the foregoing that there is good ground for satisfaction with the growth of the company's business during the past year, the results comparing favourably with those of similar undertakings in Australia and elsewhere. The Adelaide Electric Supply Co., Ltd., has continued to make satisfactory progress during the year; and a dividend at the rate of 6 per cent. on the ordinary shares was declared and paid on the 6th inst., for the year ended August 31st, 1909, credit for which has been taken in this company's profit and loss account. Mr. David Finlayson has joined the board of the company in London, and a local board has been formed in Melbourne, consisting of the Hon. W. L. Baillieu, M.L.C., the Hon. Agar Wynne, M.H.R., and the company's engineer and manager, Mr. F. W. Clements.

Allgemeine Elektricitäts Gesellschaft.—At the annual meeting of the A.E.G. on December 9th, it was mentioned that a large new site had been acquired near the Hennigsdorf suburban railway station, with a frontage of 5,000 ft. to the Ship Canal between Berlin and Stettin. The land was intended for the erection of new and the amplification of existing departments. Questions as to whether porcelain ware, aeroplane and airship works were projected on the site failed to elicit any information. It was stated that a number of schemes were in preparation in connection with the projected utilisation of foreign water-powers, but no details were given. As far as the prospects of the company for the current year are concerned, it was intimated that the orders coming to hand in the new financial year had experienced an increase, and if the progress continued the stock of orders would soon overtake those in the previous year. The turnover and orders on hand on October 31st amounted to £12,650,000, as compared with £12,850,000 on the corresponding date in 1908. It was explained that the slight reduction was due to the end of the remainder of the orders resulting from the late period of general prosperity, as well as of orders from the Berlin Electricity Works, which were restricting extensions. If unforeseen events did not occur, the A.E.G., which was fully employed, could look forward with confidence to the working results for 1909-10.

Eastern Telegraph Co., Ltd.—The directors have declared a third quarterly interim dividend of 1¼ per cent. on the ordinary stock, free of income-tax.

British Columbia Electric Railway Co.

The annual general meeting of this company was held on Thursday of last week at the Great Eastern Hotel, Liverpool Street, Mr. R. M. Horne-Payne presiding.

Mr. Brown, solicitor to the company, read the chairman's speech, which stated that the traffic increases for the past few months had been enormous. A considerable part of this increase had been due to the thousands of visitors who had come to Vancouver and Victoria, after visiting the great World's Fair at the neighbouring City of Seattle in the United States, and they had also been benefiting abnormally from the very large salmon run this year. The company served a great many of the largest salmon canneries, and it was a peculiarity of this trade that every fourth year a very large catch was secured, whereas in the following year the catch was correspondingly small. When, therefore, they came to the summer of next year, it was not to be expected that they would show increases over the traffics of the present year, and he wanted to forewarn shareholders of this, so that they might not be alarmed. They had had increases in traffic, week by week and month by month, for so long that, unless forewarned, a decrease or two might possibly have an unsettling effect on the shareholders, and be magnified into almost a disaster, and he would therefore point out that they could afford to lose a considerable amount of the exceptional earnings of the last few months without their dividends being in the least endangered. Behind, and in addition to, this exceptional increase in business, there was a steady and regular progress in the normal development of the cities and territory which they served, which was indicated in many unmistakable ways, such as the increase in building in the cities and the increase in land settlement in the rural districts, and the enormous increase in the number of electric lights and the amount of electric power which the company supplied. During the year the City had greatly expanded, and settlement in the surrounding country had enormously increased. Many large and costly mercantile buildings, banks, offices, warehouses and shops had been erected, and the whole of the residential sections of the City were now entirely built up, with the result that building operations had been very largely extended to the outlying districts served by the company, and it had become necessary to extend their services to these newly settled districts. They had done this under agreements with the various municipalities which amply protected them, and afforded guarantees that they would in years to come reap the reward of their energy and enterprise, but as new lines of railway through newly settled country could not be expected to pay their way from the outset, they must expect that their working expenses would bear for the next few years a higher proportion to profits than they had hitherto done. The board had gone into this policy of extension with the utmost caution, and were absolutely satisfied of its wisdom, and again this year one of the directors had given his entire time for months to visiting British Columbia, and studying conditions on the spot with their invaluable local board and the management. It was satisfactory to know that the increased receipts had been obtained in spite of the reductions in railway charges, and in spite of a reduction of no less than 17 per cent. in their electric lighting tariff—reductions which placed the company's charges on as low a basis as those prevailing in any city in Canada or the United States with but one solitary exception. Those reductions were made spontaneously by the company without waiting for any outside pressure, in pursuance of their definite policy of giving the best and the cheapest service that they could afford to, and they were only rendered possible by the economical administration of the past, by the firm basis on which their old friend and former general manager, Mr. Buntzen, built up the enterprise, and by the skill and the devoted service to the company of the present officers, staff and men. The total investment had been increased during the year by $2,500,000, and they now had over $13,500,000 of cash invested in British Columbia, on which they were this year paying an average of 5·29 per cent. in interest and dividends. Last year the average return paid on their investment was 5·66 per cent., and the reduction was accounted for by the fact that they had raised during the year and invested $2,500,000 by the sale of debenture stock, yielding a little over 4½ per cent. The shareholders would have heard a great deal during the year of threatened opposition and competition. The directors viewed this forthcoming competition with great complacency, and he might say with satisfaction. They were absolutely confident that no other enterprise could supply as good and as cheap services as they did, and they welcomed the advent of a competitor, as it would demonstrate to the public more clearly than anything else could, that there was nothing in the cry which was sometimes raised by various cantankerous and ignorant individuals, against their having a monopoly of the electrical business. They stood entrenched against competition behind very low rates, good services, and a constant study of the rights of the public.

Mr. G. P. Norton seconded the motion for the adoption of the report.

Replying to questions by shareholders as to whether the directors could account for a recent article which appeared in the financial papers, Mr. Brown said that it was a reckless and an unfounded rumour that the company had realised its investments and that the directors had been getting rid of their holdings. Of the three directors mentioned, Mr. R. K. Spurgeon was deceased, and his shares had passed to his executors; the Hon. M. R. Gifford had actually increased his holding, and Mr. R. M. Horne-Payne held 16,500 deferred shares of the market value of £20,000, and the Misses Horne-Payne and their trustees held close on 10,000 shares. A more wild and reckless statement had never been made in the British Press, and the directors emphatically repudiated the right of any newspaper or shareholders to probe into their private affairs. If such was to be the case, it would mean that every director would be compelled to absolutely limit his interest in a company to the requirements of the articles of the association. The directors had a fairly shrewd idea as to the quarter in which the article really originated, but under the circumstances they thought it would be better to keep their mouths closed.

Answering a question as to the threatened competition, Mr. Brown said it was the development of a water power. They had had an offer for it, but had declined it. Their company already had a water-power supply which was more economical to them.

The report was then adopted.

A resolution was passed authorising the directors to increase the capital of the company to £2,500,000 by the creation of 700,000 new shares of £1 each.

Subsequently, at a special meeting, the articles of the association were altered so as to give the company power to "acquire, construct and own gas plants, systems, works and apparatus, and to supply gas and to carry on the business of a gas making and gas supply company in all its branches, and to deal in, and dispose of, all residual and other products arising in the course of carrying on such business," and, further, "to purchase, take on lease or in exchange, hire or otherwise acquire, own, utilise, turn to account and develop and sell, or otherwise deal in, land and immovable property and rights of every description relating thereto, and in particular to turn any such property and rights to account by prospecting for winning and working coal, iron, ironstone and any other metallic or mineral substances, and generally any constituents of the soil, and by cultivating and dealing in and with timber and lumber and any other products or fruits of the soil."

Provincial Tramways Co.

The fifty-second ordinary general meeting of this company was held last Friday, at the offices, Moorgate Station Chambers, Moorfields, Mr. Andrew Beattie presiding.

The Chairman, in moving the adoption of the report, said he was pleased to say that the result of the year's working had been just about the same as in the previous 12 months. They did, however, at one time anticipate that there would have been an improvement, but owing to the wet summer and autumn that anticipation had not been realised. However, they had been able to hold their own, and the receipts and the profits were equally as good as in the past. The directors had been comparing their accounts with those of other similar companies, and they found that their company showed the lowest working expenses—that was to say, they were the most economically managed. Out of every £100 they received there was a gross expenditure of £55, or 55 per cent. on the net earnings. He would like to draw their attention to the articles of association, which were more than 37 years old, and had now become almost obsolete. It was the directors' intention to bring their articles up to date and in conformity with modern usages. The shareholders would remember that some time ago the question of altering the value of the shares was considered. The company's shares were of a face value of £10, but for many years they had never stood on the market at higher than £6 or £7, and at the present time they were down to £4 10s. or so. They had nearly a quarter of a million ordinary shares, and about three years ago a proposal was made that every shareholder, in exchange for his £10 share, should receive one of £5 value. The majority of the shareholders at that time were in favour of that proposal. The scheme, however, was never proceeded with, but the directors had been considering another proposal, which was, that every £10 share should be exchanged for five £1 shares. They proposed to submit that scheme to the shareholders shortly, and he thought everyone would agree that £1 shares would be more advantageous than the £10 shares. Their reserve fund now stood at £47,500, and that account was used for renewals and depreciation, and was altogether apart from the ordinary maintenance of the lines. As to the future, they believed that if the weather was at all fine the accounts would show an improvement.

Mr. S. Hern seconded the motion, and after a short discussion the report was adopted.

Prior to the above meeting, the annual meetings of the respective local companies were held, under the presidency of Mr. A. Beattie, at which the reports and accounts were adopted.

Russian Electrical Companies.—It is reported from St. Petersburg that all the electrical companies in that city in which German capital is interested are satisfied with the working results in so far as the present year is concerned. These undertakings are the United Cable Works Co., which has a capital of £480,000, and in which the Berlin A.E.G. and the Siemens and Halske Co. are large holders; the Russian Siemens & Halske Co., with a share capital of £560,000; the Electric Lighting Co. of 1886, with a capital of £2,400,000; the Russian Schuckert Co., with £200,000; and the Russian General Electricity Co., with £700,000. It is estimated that the Electric Lighting Co. of 1886 will be able to pay a higher dividend for 1909 than for 1908, that the rate of distribution of the United Cable Works Co. will be 8 per cent. as compared with 7 per cent. in 1908, and that the Schuckert Co. and the Siemens & Halske Co. will again pay 3 and 4 per cent. respectively.

Winnipeg Electric Railway Co.—The British Empire Trust Co. announces that this company has declared a dividend of 2½ per cent. for the quarter ending 31st inst.

ELECTRIC TRAMWAY AND RAILWAY TRAFFIC RETURNS.

Locality.	Fortnight ended.	Receipts for the fortnight. £	£*	No. of wks.	Total to date. £	£*	Route miles open.	Inc.
Aberdeen	Dec. 8	2,408	— 64	26	39,094	— 909	..	..
Ayr	,, 11	344	— 21	20	9,367	— 147	8	..
Bath	,, 11	1,278	+ 22	49	37,645	+ ,337	..	..
Belfast	,, 10	7,490	+ 53	35	199,226	+ 5,291	37	..
Birkenhead	,, 12	2,178	+ 118	36	89,228	— 441	13·63	..
Birmingham Corp.	,, 4	13,223	+ 256	36	235,116	+ 6,735	..	..
Blackburn	,, 8	1,903	..	37	40,865	— 1,243	..	..
Blackpool Corp.	,, 9	688	+ 17	..	49,324	+ 4,121	..	..
Blackpool-Fleetw'd	,, 11	450	— 4	23	22,215	+ 1,367	..	..
†Bolton	,, 5	2,220	+ 120	36	84,092	+ 255	26	..
Bournemouth	,, 8	2,490	+ 38	36	61,900	+ 357	21·93	..
Bradford	,, 4	8,722	+ 703	35	174,414	+ 5,927	54·81	..
Brighton	,, 12	1,452	+ 64	37	36,861	+ 1,650	9·5	..
Bristol	,, 10	10,404	+ 864	..	..	..	..	..
Brit. Elec. Trac. Co.								
Airdrie	Dec. 3	422	— 18	48	10,530	— 180	3·65	..
Barnsley	,, 3	328	+ 11	,,	8,113	— 373	..	..
Barrow	,, 3	400	+ 1	,,	11,150	— 592	5·37	..
Cavehill	,, 3	101	— 5	,,	4,098	— 105	..	..
Devonport	,, 3	661	— 222	,,	17,675	— 4,691	8·85	..
Gateshead	,, 3	1,943	— 8	,,	47,889	— 532	11·25	..
Gravesend	,, 3	375	— 20	,,	10,138	+ 26	6·5	..
Greenock	,, 3	971	+ 62	,,	26,700	+ 1,528	7·25	..
Hartlepool	,, 3	425	+ 28	,,	11,344	— 75	6·72	..
Kidderminster	,, 3	180	+ 22	,,	5,179	— 144	..	..
Leamington	,, 3	323	+ 54	,,	8,526	+ 211	..	..
Merthyr	,, 3	364	— 60	,,	10,083	— 182	2·9	..
Metropolitan	,, 3	11,737	+1,110	,,	299,809	+22,858	22	..
Middleton	,, 3	535	— 49	,,	16,027	— 983	8·5	..
Mid. Joint Com'tee	,, 3	11,056	+ 140	,,	275,161	— 739	..	..
Oldham—Ashton	,, 3	1,000	— 23	,,	26,968	— 1,196	9·18	..
Peterborough	,, 3	190	— 1	,,	5,695	— 431	5·31	..
Potteries	,, 3	3,804	+ 70	,,	86,738	— 414	29	..
Rothesay	,, 3	71	— 10	,,	9,842	+ 116	2·75	..
Southport	,, 3	411	— 21	,,	13,772	— 447	8·17	..
S. Metropolitan	,, 3	1,331	— 33	,,	38,366	— 590	..	..
Swansea	,, 3	1,948	+ 198	,,	47,054	+ 1,606	12·5	..
Tynemouth	,, 3	256	— 6	,,	11,670	+ 848	3·75	..
Weston-s-Mare	,, 3	54	+ 2	,,	7,119	+ 399	3	..
‡Worcester	,, 3	457	— 5	,,	13,412	— 139	5·75	..
Wrexham	,, 3	175	— 12	,,	4,728	— 204	..	..
Yorks. Wool. Dist.	,, 3	1,777	+ 153	,,	44,408	— 503	17	..
Miscellaneous	,, 3	363	+ 8	,,	10,060	+ 236	..	..
Burnley	,, 11	2,257	+ 156	..	..	..	..	..
Burton-on-Trent	,, 12	509	+ 34	37	9,818	— 207	6·63	..
†Bury	,, 5	1,013	+ 63	35½	41,979	— 317	22·5	..
Cardiff	,, 4	4,052	+ 114	36	79,505	+ 1,224	..	..
Carlisle	,, 11	342	— 15	49	8,075	— 443	..	..
Chatham and Dist.	,, 9	4,158	+ 1	49	40,256	+ 1,597	14·98	..
Cork	,, 9	822	— 16	..	22,029	— 643	9·89	..
†Croydon	Nov. 26	2,863	+ 362	..	54,648	+ 4,649	11·25	4·75
Darlington	Dec. 11	356	— 1	37	6,838	— 488	..	..
†Darwen	,, 3	484	+ 30	35	8,890	— 105	4·36	..
Dover	,, 4	307	+ 12	36	7,763	— 406	4·75	..
Dublin	,, 10	9,862	+ 122	..	129,036	+ 1,995	54·25	..
Dundee	,, 8	2,195	— 96	23½	35,172	— 763	15·5	..
East Ham	,, 11	1,876	+ 168	36½	36,920	+ 4,514	8·52	·77
Exeter	,, 10	544	+ 9	37	12,443	+ 576	..	..
Glasgow	,, 11	31,712	+1,600	..	463,141	— 9,081	94½	5
Hastings	,, 9	1,338	— 149	..	..	..	..	..
Huddersfield	,, 11	3,166	+ 341	36	61,151	+ 2,748	28·5	·5
Hull	,, 11	5,362	+ 604	36	94,754	+ 3,920	14·5	1·5
Ilkeston	,, 8	117	+ 1	36	4,928	— 238	..	..
Ipswich	,, 11	628	+ 42	37	14,972	+ 181	10·5	..
Kilmarnock	,, 4	269	— 19	29	4,281	— 168	4·25	..
Lancashire United	,, 8	2,229	+ 30	49	64,297	— 789	..	..
Leeds	,, 4	12,717	+ 715	35	248,743	+ 6,984	..	..
Leicester	Nov. 27	4,037	+ 109	..	..	..	..	..
Leith	Dec. 11	1,023	+ 75	30	18,418	+ 2,191	9	3
Liverpool	,, 4	20,937	+ 276	48	518,120	— 1,482	..	..
†L.C.C.	Nov. 27	72,559	+4,614	..	1,279,116	+56,917	..	..
London United	Dec. 11	10,113	+ 73	..	295,942	—28,866	..	..
Lowestoft	,, 11	322	+ 30	11	1,769	+ 30	3·5	..
Manchester	,, 11	28,374	+ 149	36	549,701	— 7,627	..	..
Newcastle	,, 11	7,759	+ 133	..	142,732	— 1,204	14·5	..
†Newport	Nov. 26	552	— 36	35	22,995	— 348	14·5	..
Oldham	Dec. 12	3,241	— 256	37	68,611	— 4,819	23·75	..
Pontypridd	,, 11	753	+ 12	36½	15,137	+ 1,077	5·5	..
†Portsmouth	,, 4	1,661	+ 79	36	76,668	— 2,331	14·5	..
Preston	,, 8	1,327	+ 3	..	..	..	..	..
Rotherham	,, 9	1,127	+ 22	36	21,381	— 1,037	10	..
Salford	,, 6	8,842	— 77	36	163,915	— 4,474	..	..
Sheffield	,, 12	11,427	+ 896	..	..	..	..	..
Southampton	,, 8	1,884	+ 83	36	39,091	— 322	..	..
Southend-on-Sea	,, 8	685	+ 35	36	19,979	+ 2,615	..	..
South Shields	,, 11	1,049	+ 56	36½	20,747	+ 15	..	..
†Swindon	,, 8	126	+ 12	37½	211,307	+ 2,244	..	..
Tyneside	,, 8	786	— 11	23	9,991	+ 818	..	..
Wallasey	,, 11	1,597	+ 3	36½	34,074	+ 692	..	·22
Walthamstow	,, 11	1,155	+ 117	37	24,411	+ 552	9	..
West Ham	,, 2	4,347	+ 327	35	82,920	+ 4,919	15·25	·43
Wolverhampton	,, 8	1,690	+ 191	36	30,383	+ 189	14·25	1·75
Baker St.-Waterloo	,, 11	7,205	+ 680	23	72,475	+ 2,265	4·25	..
Cen. London Rly.	,, 11	11,778	+ 188	23	121,947	—42,939	6·32	·55
Char. +, Eus. Hamp.	,, 11	7,665	+ 595	23	86,295	+ 8,775	7·75	..
City & S. Lon. Rly.	,, 12	6,888	+ 432	23	72,744	+ 2,792	7·3	..
Dublin-Lucan Rly.	,, 10	199	— 18	23	3,331	+ 40	7	..
G.N. and City Rly.	,, 11	3 046	+ 93	23	31,030	+ 244	3.5	..
G.N., P'y. & Brmtn.	,, 11	12,545	+1,105	23	124,325	+ 5,560	9·25	..
L'pool Overh'd Rly.	,, 12	2,528	— 54	23	33,332	— 80	6·8	4·3
†Llandudno-Col. Bay	,, 10	108	+ 11	1½	157	— 1	..	..
Mersey Railway	,, 11	3,953	— 21	23	44,908	+ 1,641	4·5	..
Mesropolitan Rly.	,, 12	35.472	+1,844	23	373,872	— 2,105	24·5	..
Met. District Rly.	,, 11	21,338	+2,152	23	228,594	+12,815	24	..
Anglo-Argentine	,, 9	86,680	+2,784	..	1,941,081	+117,412	..	..
§Auckland	,, 8	14,816	+1,292	48	164.769	+14.899	22·3	1·33
Bombay (B.E.T.)	Nov. 11	5,644	+ 90	45	118,855	+ 5,518	..	..
§Brisbane	,,	16,170	+1,666	..	..	..	..	..
§Brit. Columbia Rly.	..	..	..	..	..	..	..	..
Calcutta	Dec. 11	6,943	+ 214	..	..	..	..	..
§Cape Electric T. Ld.	..	..	..	..	..	..	..	..
§Kalgoorlie, W.A.	Nov.	3,899	..	..	41,472	..	20·5	..
Madras	Nov. 15	1,869	+ 220	..	27,083	+ 1,156	..	..
§Lisbon	..	..	..	..	..	..	..	..
Perth (W.A.)	Dec. 10	2,984	+ 57	..	68,790	+ 878	28	2·4

* Compared with the corresponding period of 1908. † One week only.
‡ Includes horse, steam and other receipts. § One month.

STOCKS AND SHARES.

Tuesday Afternoon.

THE very unexpected reduction in the Bank Rate last Thursday led to a general hardening up of prices which, just before, had been disposed to sag. Its effect, however, was short-lived, for Consols turned downward, and other investment securities followed their lead.

Much of the recent strength has already been exhausted in the Home Railway boomlet. Reared on a slender foundation, the base of the rise gave signs of shaking after the market had enjoyed about four days of something like activity. People took their profits, business became normally quiet, and once more the attitude has fallen into mere expectation.

Market authorities profess to be fully satisfied with the results achieved by the London, Brighton and South Coast Railway from its electrified portion. The price of the Deferred stock ranged between 81½ and 86½ last week, and now stands about 85¼, carrying a full year's dividend payable in February next.

Central London Ordinary stock has improved, and there is ½ rise in City and South London Ordinary. On the other hand, Metropolitan Consolidated shed ¼ of its recent swift spurt, although the Surplus Lands is up a point to 67. Districts at 18 are ½ to the good, and Underground Electric Railway securities have risen. The prior-charge stocks maintain their strength, being mostly full of dividend, and with a further reduction in the Bank Rate to anticipate as an early occurrence in the New Year.

It is remarked upon as somewhat singular that the Stock Exchange—usually so ready to discount possibilities that may affect its markets—is not speculating upon the chances of a Protectionist victory at the forthcoming General Election, in spite of the difference which such an event would exercise upon the fortunes of numberless industrial undertakings. And this is considered all the more surprising in view of the fact that the House, as a whole, is ardently anti-Budget.

The British Empire Trust has issued a pamphlet containing useful details of the companies comprised in its group, but the publication has not gone so far as to influence quotations. British Columbia Electric Railway Deferred has recovered part of the dividend deducted on December 10th, and the Preferred is a point higher, the same gain being secured by Auckland Trams 5 per cent. Debenture stock. Anglo-Argentine shares and Debenture stock are also a shade harder. Mexico Trams lost a small fraction, and Rio Trams fell back to 93. Mexican Light and Power is a trifling amount to the good.

British Electric Tractions, Brush shares and London United Trams are without quotable change. It is worth noticing that London General Omnibus stock has risen within a week from 17 to 25, whence it fell again to 23, the view being taken that the company has seen the worst of its black days.

Amongst electricity supply issues, Smithfield Markets are nominally 7/16 lower, but the widening of the official price causes that quotation to become so much the less reliable. One or two of the London Companies' shares have hardened, on the assumption, mentioned here last week, that the little advertising campaign in favour of radiators is already bearing useful fruit. City Lights are ⅛ better, and so are Metropolitans. Chelseas, on the other side of the sheet, have declined 5s. A moderate inquiry for Central Electric Debenture stock found there was little in the market, and the price has been marked up 2, to 100½.

In the telegraph department there is a general quietude. Eastern Ordinary stock and Western Telegraph shares are better. Anglo-American Telegraph 6 per cent. Preferred hardened to 100⅜, and as a speculative stock it cannot be thought extravagantly valued, even at that. The Deferred is rather easier. Marconi shares fell 2s. 6d. to 11s. 3d. middle. Globe Ordinary, *ex* 2s. dividend, are quotably unchanged, but the Preference marked the deduction of the 3s. dividend by a 5s. fall. National Telephones are good. American Telephone capital stock rose 1½. Mackay issues, allowing for the dividends, are practically without alteration.

Manufacturing and miscellaneous shares are a trifle irregular. British Aluminiums have receded. Henley Preference lost 2s. 6d. Castner-Kellner shares at 2 5/16 show a small rise, and Dick, Kerr Preference are ½ better. Telegraph Constructions eased off. Rubber shares are mostly quiet, the market being subdued in view of the latest auction prices for the product.

Shawinigan Water and Power Co.—The directors have decided to offer $500,000 common stock to shareholders on the register on December 9th on the basis of one new share for each 13 old shares held. The new shares will not participate in dividend payable in January.

SHARE LIST OF ELECTRICAL COMPANIES.

TELEGRAPH AND TELEPHONE COMPANIES.

Present Issue.	NAME.	Stock or Share. *	Dividends for the last four years. 1905.	1906.	1907.	1908.	Closing Quotations Dec. 7th.	Closing Quotations Dec. 14th.	Business done week ended Dec. 14th, 1909. Highest.	Lowest.	Rise + or Fall −	Present Yield per cent. £ s. d.
25,000	Amason Telegraph Co.'s shares, Nos. 1 to 25,000	10	Nil	Nil	Nil	Nil	3⅜ — ⅞	⅜ — ⅞	68/1½	..	..	Nil.
196,700	Do. do. 5 % Debs., Nos. 1 to 1,350 Red.	100	5 %	5 %	5 %	5 %	100 - 103	100 —103	..	..	..	4 17 1
$181,551,400	American Telephone & Telegraph, Cap. Stock ..	$100	7½%	8 %	8 %	8 %	143 —146	145 —147	144½	..	+ 1½	5 8 10
$68,000,000	Do. Collat. Trust, 4% Bonds, 1 to 28,000 and 58,001 to 78,000	$1000	4 %	4 %	4 %	4 %	96 — 98	96 — 98	..	..	..	4 1 8
558,460	Anglo-American Telegraph	Stock	3½%	3½%	3½%	£3 1s.	60 — 62	60 — 62	..	..	..	5 8 4
3,220,770	Do. do. do. 6 % Pref.	Stock	6 %	6 %	6 %	6 %	100 —101	100½—101½	101	101½	+ ½	5 18 0
3,220,770	Do. do. do. Deferred	Stock	1½%	1½%	1 %	8/-	21⅞ — 22⅛	21⅝ — 21⅞	22⅝	21⅝	— ¼	1 16 2
47,725	Anglo-Portuguese Tel., 5 % Mort. Deb. Stock Red.	100	5 %	5 %	5 %	5 %	101 —103	101 —103	102½	..	..	4 17 1
44,000	Chili Telephone, Nos. 1 to 44,000	5	8 %	8 %	8 %	8 %	7⅞ — 8⅛	7⅞ — 8⅛	..	..	+ 1/16	4 18 6
2,481,850	Commercial Cable, Sting. 600 year 4% Deb. Stk. Red.	Stock	4 %	4 %	4 %	4 %	86⅛ — 88½	86⅛ — 88½	87½	86½	..	4 10 5
16,000	Cuba Telegraph	10	5 %	5 %	6 %	6 %	8⅝ — 9⅛	8⅝ — 9⅛	..	..	..	6 9 9
6,000	Do. 10 % Pref.	10	10 %	10 %	10 %	10 %	17 — 18	17 — 18	..	..	..	5 11 1
12,981	Direct Spanish Telegraph, Ord.	5	4 %	4 %	4 %	4 %	8 — 8¼	8 — 8¼	..	..	..	5 14 8
6,000	Do. do. 10 % Cum. Pref. ..	5	10 %	10 %	10 %	10 %	8 — 8¼	8 — 8¼	..	..	..	6 5 0
30,000	Do. do. 4½ % Debs.	50	4½%	4½%	4½%	4½%	100½—102½	100½—102½	..	..	..	3 3 11
60,710	Direct United States Cable	20	4½%	4½%	4½%	4½%	13 — 13½	13 — 13½	..	..	..	6 4 7
48,500	Direct W. India Cable, 4½ % Reg. Deb., 1 to 1,900, R.	100	4½%	4½%	4½%	4½%	100 —102	100⅛ —102⅛	..	..	+ ⅛	4 7 10
4,000,000	Eastern Telegraph, Ord. Stock..	Stock	7 %	7 %	7 %	7 %	131 —134	132 —135	134	131¾	+ 1	5 3 8
2,000,000	Do. 5½ % Pref. Stock..	100	5½%	5½%	5½%	5½%	84½ - 86½	84½ - 86½	85⅞	84⅜	..	4 0 11
1,896,706	Do. 4 % Mort. Deb. Stock. Red. ..	Stock	4 %	4 %	4 %	4 %	102 —104	102 —104	103	..	..	3 16 11
800,000	Eastern Extension, Australasia, and China Tele	10	7 %	7 %	7 %	7 %	11½ — 12½	11½ — 12½	12½	11⅞	..	5 14 8
752,400	Do. 4 % Deb. Stock	Stock	4 %	4 %	4 %	4 %	102 —104	102 —104	..	..	..	3 16 11
200,000	East. & S. Afric. Tel., 4 % Mt Db. Mauritius Sub.) 1 to 8,000	25	4 %	4 %	4 %	4 %	100 —102	100 —102	..	..	..	3 18 5
181,127	Globe Telegraph and Trust	10	5½%	5½%	5½%	5½%	10½ — 10⅝	10½ — 10⅝xd	10⅛	10⅝	..	5 7 0
181,127	Do. do. 6 % Pref..	10	6 %	6 %	6 %	6 %	13½ — 14	13½ — 13⅝	13⅝	13⅜	— ⅛	4 7 3
150,000	Great Northern Telegraph, of Copenhagen.. ..	10	24%	20 %	20 %	18 %	30 — 31	30 — 31	31½	..	..	5 16 2
10,000	Halifax and Bermudas Cable, 4½ % 1st Mort. Debs., within Nos. 1 to 1,200, Red.	100	4½%	4½%	4½%	4½%	100 —102	100 —102	..	..	..	4 8 3
17,000	Indo-European Telegraph	25	13 %	13 %	13 %	13 %	51 — 53	51 — 53	52½	..	..	7 1 2
$41,380,400	Mackay Companies Common	$100	2 %	3½%	4 %	4 %	96 — 98	95 — 97 xd	..	..	..	4 2 6
$50,000,000	Do. do. 4% Cum. Pref.	$100	4 %	4 %	4 %	4 %	77 — 79	76 — 78 xd	..	..	..	5 2 7
394,190	Marconi's Wireless Telegraph	1	Nil	Nil	Nil	Nil	⅜ — ½	⅜ — ½	..	..	— ⅛	Nil
72,680	Monte Video Telephone Co., Ltd. Ord.	1	5 %	5 %	6 %	6 %	⅜ — ½	⅜ — ½	..	..	..	6 8 0
86,493	Do. do. do. 5 % Pref. ..	1	5 %	5 %	5 %	5 %	⅜ — ½	⅜ — ½	..	..	..	5 6 8
2,295,000	National Telephone, Pref. Stock	100	6 %	6 %	6 %	6 %	106½ —108	106½ 108	107	..	..	5 11 1
3,795,000	Do. do. Def. Stock	100	5 %	5 %	6 %	6 %	120½—122½	122 —124	123	121	+1½	4 16 9
15,000	Do. do. 6 % Cum. 1st. Pref.	10	6 %	6 %	6 %	6 %	10½ — 11	10½ — 11	10⅞	..	..	5 9 1
15,000	Do. do. 6 % Cum. 2nd Pref.	10	6 %	6 %	6 %	6 %	10⅜ — 10⅝	10⅜ — 10⅝	..	..	..	5 10 4
250,000	Do. do. 5 % Non-cum. 3rd P., 1 to 250,000	5	5 %	5 %	5 %	5 %	5⅜ — 5⅝	5⅜ — 5⅝	5⅝	..	..	4 8 11
2,000,000	Do. do. 3½ % Deb. Stock Red. ..	Stock	3½%	3½%	3½%	3½%	98 - 100	98 —100	..	..	..	3 10 0
1,968,593	Do. do. 4 % Deb. Stock Red.	100	4 %	4 %	4 %	4 %	100 —102	100 —102	100½	..	..	3 18 5
179,318	Oriental Telep. and Elec. 1 to 171,504, fully paid ..	1	7 %	7 %	8 %	8 %	1⅜ — 1½	1⅜ — 1½	27/6	..	..	5 5 9
50,000	Do. do. do. 6 % Cum. Pref.. ..	1	6 %	6 %	6 %	6 %	1⅞ — 1⅞	1⅞ — 1⅞	..	..	..	4 14 9
99,100	Do. do. do. 4 % Red. Deb. Stock ..	100	4 %	4 %	4 %	4 %	87⅞ - 89½	87⅞ — 88½	..	..	..	4 9 11
99,400	Pacific & European Tel., 4 % Guar. Debs., 1 to 1,000	10	4 %	4 %	4 %	4 %	100 - 102	100 —102	..	..	..	3 18 5
11,839	Reuter's	8	5 %	5 %	5 %	5 %	7⅞ — 8⅛	7⅞ — 8⅛	..	..	..	4 18 9
145,955	Telephone Co. of Egypt, 4½ % Deb. Red.	100	4½%	4½%	4½%	4½%	101 —103	101 —103	102½	101½	..	4 7 10
3,042	Submarine Cables Trust	Cert.	6 %	6 %	6 %	6 %	129 —132	129 —132	..	..	..	4 7 5
120,000	United River Plate Telephone	5	8 %	8 %	8 %	8 %	7 — 7½	7 — 7½	7/6	7	..	5 10 4
40,000	Do. 5 % Cum. Pref., Nos. 1 to 40,000	5	5 %	5 %	5 %	5 %	5⅛ — 5⅜	5⅛ — 5⅜	..	..	..	4 6 11
80,008	W. Coast of America, 1 to 80,000 & 53,001 to 53,008	2½	Nil	2½%	2½%	2½%	1⅛ — 1⅜	1⅛ — 1⅜	..	..	..	3 16 4
150,000	Do. 4 % Debs., 1 to 1,500 guar. by Bras. Sub. Tel.	100	4 %	4 %	4 %	4 %	100 —102	100 —102	..	..	..	3 18 5
207,980	Western Telegraph, Ltd., Nos. 1 to 207,980.. ..	10	7 %	7 %	7 %	7 %	13⅜ — 13⅝	13⅜ — 14	13⅞	13½	+ ⅛	5 0 0
800,000	Do. do. 4 % Deb. Stock Red. ..	100	4 %	4 %	4 %	4 %	103 —105	103 —105	103	..	..	3 16 2
88,321	West India and Panama Telegraph	10	Nil	Nil	Nil	Nil	⅜ — ½	⅜ — ½	..	..	..	Nil
84,553	Do. do. 6 % Cum. 1st Pref.	10	5 %	5 %	6 %	6 %	8½ — 9¼	8½ — 9¼	..	..	..	6 9 9
4,669	Do. do. 6 % Cum. 2nd Pref.	10	Nil	Nil	£2 6	15 %	8 — 9	8 — 9	..	..	..	6 18 4
93,000	Do. do. 5 % Debs., Nos. 1 to 1,800 ..	100	5 %	5 %	5 %	5 %	102 —104	102 —104	..	..	..	4 16 2

ELECTRICAL RAILWAY, MANUFACTURING AND INDUSTRIAL COMPANIES.

640,000	Anglo-Argentine Trams, 5 % Cum. 1st Pref., 1 to 640,000	5	..	..	..	..	4⅞— 4¹⅛	4½ — 4⅝	91/10½	90/-	+1/16	5 5 3
800,000	Do. 5 % 2nd Pref., 800,001 to 1,300,000	5	..	..	..	..	4⅛— 4⅜	4⅛— 4⅜	..	..	..	5 11 1
978,230	Do. 4 % Deb. Stock	Stock	..	..	..	4 %	90½ - 92	91½—93	92⅜	91½	+1	4 6 0
382,387	Auckland E. Trams, 5 % 1st Mort. Deb. Stock ..	....	5 %	5 %	5 %	5 %	103 —106	104 —107	..	..	+1	4 13 6
250,000	Babcock & Wilcox, 1 to 250,000	1	20 %	20 %	20 %	20 %	42 — 43	42 - 43	95/7½	93/9	..	4 3 9
100,000	Do. do. 6 % Cum. Pref., 1 to 100,000 ..	1	6 %	6 %	6 %	6 %	1⅞ — 1⅞	1⅞ — 1⅞	30/-	2/9	..	8 19 2
50,000	British Aluminium, Ord., 1 to 40,000	5	7 %	7 %	7 %	Nil	½ — 1½	½ — 1	..	..	— ¼	Nil
60,000	Do. do. 7 % Cum. Pref.	5	7 %	7 %	7 %	3½ %	1⅜ — 2¼	1⅜ — 2¼	40/-	..	— ⅛	7 10 0
40,100	Do. do. "A" 6 % Cum. Pref.	5	6 %	6 %	6 %	6 %	3½ — 3¾	3½ — 3⅝	..	..	— ⅛	7 10 11
12,897	Do. do. 4 % Funding Certs.	5	4 %	4 %	4 %	2 %	2⅜ — 3½	2⅜ — 3½	..	..	..	5 11 1
124,400	Do. do. 5½ % Loch Leven Debs. ..	100	..	5½%	5½%	5½%	96 — 99	96 — 99	..	..	..	5 14 7
800,000	British Columbia E. Rail Def. Ord. Stock	100	6 %	6 %	8 %	8 %	141 —145	138 —142 xd	..	..	..	5 12 8
400,000	Do. Pref. Ord. Stock	100	5 %	5 %	5 %	6 %	120 —124	121 —125	122	..	..	4 16 9
400,000	Do. 5 % Cum. Perp. Pref. Stock	100	5 %	5 %	5 %	5 %	107 —110	107 —110	107½	..	..	4 11 9
288,000	Do. 4½ % 1st Mort. Debs., 1 to 6,250	40	4½%	4½%	4½%	4½%	102 —104	102 —104	..	..	..	4 6 7
212,600	Do. 4½ % Vancouver Power Debs., 1 to 2,200	100	4½%	4½%	4½%	4½%	102 —105	102 —105	104	..	..	4 6 2
188,301	British Electric Traction	10	3 %	Nil	Nil	Nil	⅜ — 1	⅜ — 1	..	..	..	Nil
161,497	Do. do. 6 % Cum. Pref.	10	6 %	6 %	8 %	14%	2⅜ — 3	2⅜ — 3	..	..	..	5 0 0
1,478,658	Do. do. 5 % Perp. Deb. Stock ..	Stock	5 %	5 %	5 %	5 %	84 — 87	84 - 87	84⅜	84½	..	5 14 11
598,936	Do. do. 4½ % 2nd Deb. Stock Red.	100	4½%	4½%	4½%	4½%	60 — 65	60 - 65	61	..	..	7 10 0
100,000	British Insulated and Helsby Cables	5	8 %	10 %	10 %	10 %	7 — 7¼	7 — 7¼	..	..	..	6 13 4
100,000	Do. do. 6 % Cum. Pref.	5	6 %	6 %	6 %	6 %	6¼ — 6½	6¼ — 6⅝	6⅛	..	+ ⅛	4 10 7
600,000	Do. do. 4½ % 1st Mort. Deb. Red. ..	100	4½%	4½%	4½%	4½%	103 —106	103 - 106	..	..	..	4 4 11
904,940	British Thomson-Houston 4½ % 1st Mort. Debs. ..	100	4½%	4½%	4½%	4½%	89 — 94	89 — 94	..	..	..	4 15 9
400,000	British Westinghouse 6 % Pref., 1 to 200,000 and 275,001 to 75,000	5	Nil	Nil	Nil	Nil	⅜ — ½	⅜ — ½	9/6	..	..	Nil
1,016,858	Do. do. 4 % Mort. Deb. Stock ..	100	4 %	4 %	4 %	4 %	48 — 52	48 — 52	..	..	..	7 13 10
50,000	Browett, Lindley & Co., Ord.	1	Nil	Nil	Nil	Nil	⅛ — ¼	⅛ — ¼	..	..	..	Nil
50,000	Do. do. 6 % Cum. Pref.	1	Nil	Nil	Nil	Nil	14/6 to 15/6	14/6 to 15/6	..	..	..	Nil
140,976	Brush Electrical Engineering, Ord., 1 to 105,781 ..	2	2½%	Nil	Nil	Nil	0 — ⅛	0 — ⅛	..	..	..	Nil
200,000	Do. do. Non-cum. 6 % Pref.	2	6 %	Nil	Nil	Nil	0 — ⅛	0 — ⅛	..	..	..	Nil
125,000	Do. do. 4½ % Perp. Deb. Stock ..	Stock	4½%	4½%	4½%	4½%	41 — 46	41 — 46	41½	41½	..	9 16 8
125,000	Do. do. 4½ % Perp. 2nd Deb. Stock..	Stock	4½%	4½%	4½%	4½%	27 — 31	27 — 31	..	..	..	14 10 2
187,610	Calcutta Trams, 1 to 187,610	5	8 %	8 %	6 %	4½%	4½ — 5	4½ — 5	..	..	..	4 0 0
45,804	Do. 5 % Cum. Pref., Nos. 1 to 29,830..	5	5 %	5 %	5 %	5 %	4½ — 5	4½ — 5	..	..	..	5 0 0
850,000	Do. 4½ % 1st Deb. Stock..	100	4½%	4½%	4½%	4½%	101 —104	101 —104	..	..	..	4 6 7
35,000	Callender's Cable Construction shares	5	15 %	15 %	15 %	15 %	10 — 10⅞	10 — 10⅞	..	..	..	6 19 4
40,000	Do. do. 5 % Cum. Pref.	5	5 %	5 %	5 %	5 %	5⅛— 5⅜	5⅛— 5⅜	..	..	..	4 8 11
900,000	Do. do. 4½ % 1st Mort. Deb. Stock Red.	Stock	4½%	4½%	4½%	4½%	105 —107	105 —107	..	..	..	4 4 1
491,222	Cape F. Trams., 1 to 491,223	1	Nil	Nil	Nil	Nil	1/16 — 1/8	1/16 — 1/8	..	..	..	Nil
450,000	Castner-Kellner Alkali, 1 to 450,000	1	6 %	8 %	12 %	12½%	2⅜ — 2⅝	2½ — 2⅝	46/3	45/-	+ 1/16	5 5 3
910,158	Do. do. 4½ % 1st Mort. Deb. Stock	100	4½%	4½%	4½%	4 %	106 —109	105 —108	107	..	—1	3 14 1
1,890 690	Central London Railway, Ord. Stock..	Stock	4 %	4 %	3 %	3½%	61 — 63	62 — 64	63½	62½	+1	6 1 7
554,655	Do. do. 4 % Pref. Stock	Stock	4 %	4 %	4 %	4 %	84 — 86	84 — 86	86	..	..	4 13 0
554,655	Do. do. Def. do.	Stock	4 %	4 %	2 %	2½%	44 — 46	44 — 46	46	45½	..	5 8 8
1,480,000	City and South London Railway	Stock	12½	12½	2½%	14½	30½ 31½	31 — 32	32	31	+ ½	4 13 9
85,000	Crompton & Co., Nos. 1 to 85,000	5	2½%	5 %	5 %	5 %	½ — 1	½ — 1	..	..	..	15 1 8
100,000	Do. 5 % 1st Mort. Reg. Debs., 1 to 900 of £188, and 901 to 11,000 of £50 Red		5 %	5 %	5 %	5 %	90 — 93	90 — 93	..	..	..	5 7 6

* Unless otherwise stated, all shares are fully paid.

‡ From Manchester Share List.

Continued on next page.

SHARE LIST OF ELECTRICAL COMPANIES.— *(Continued.)*

ELECTRICAL RAILWAY, MANUFACTURING AND INDUSTRIAL COMPANIES.—*(Continued)*

Present Issue.	NAME.	Stock or Share.	Dividends for the last four years. 1905.	1906.	1907.	1908.	Closing Quotations Dec. 7th.	Closing Quotations Dec. 14th.	Business done week ended Dec. 14th, 1909. Highest	Lowest.	Rise + or Fall —	Present Yield per cent. £ s. d.
250,000	Dick, Kerr & Co., 1 to 250,000	1	10 %	10 %	10 %	6 %	1 — 1⅛	1 — 1⅛	20/-		..	6 0 0
305,000	Do. do. 6 % Cum. Pref., 1 to 305,000 ..	1	6 %	6 %	6 %	6 %	1 — 1⅛	1⅛ — 1⅜	22/6	22/3	+ 3/16	5 4 4
271,080	Do. do. 4½ % Deb. Stock	100	4½ %	4½ %	4½ %	4½ %	100 —103	100 —103	..	..	..	4 7 5
60,000	Dublin United Trams. (1896), 6 % Pref., 1 to 60,000	10	6 %	6 %	6 %	6 %	12⅜ — 13⅜	12⅜ — 13⅜	..	..	..	4 7 8
99,261	Edison & Swan Utd., "A" shs., £3 pd., 1 to 99,261	5	4½ %	4½ %	2½ %	Nil	3/32 — 7/32	3/32 — 7/32	..	..	..	Nil
17,189	Do. "A" shares, 01—017,189 ..	5	4½ %	4½ %	2½ %	Nil	1 — 1¼	1 — 1¼	..	..	..	Nil
307,895	Do. 4 % Deb. Stock Red.	100	4 %	4 %	4 %	4 %	66 — 71	66 — 71	..	..	..	5 19 1
67,720	Do. 5 % 2nd Deb. Stock Prov. Certs. all pd.	100	5 %	5 %	5 %	5 %	81 — 84	81 — 84	..	..	..	5 19 1
112,100	Electric Construction, 1 to 112,100	5	Nil	Nil	Nil	Nil	5/16 — 7/16	5/16 — 7/16	7/6	..	..	Nil
51,890	Do. do. 7 % Cum. Pref., 1 to 51,890..	5	7 %	7 %	7 %	7 %	1⅛ — 1¼	1⅛ — 1¼	..	..	..	10 4 0
25,000	General Electric Co. (1909), 5 % Cum. Pref. ..	10	5 %	5 %	5 %	5 %	8 — 8½	8 — 8½	..	..	..	5 17 8
200,000	Do. do 4 % Mort Deb... ..	Stock	4 %	4 %	4 %	4 %	83 — 87	83 — 87	..	..	..	4 12 0
78,000	Gt. N. & City Rail. Pref. Ord. "A" 4 %, 1 to 78,000	10	4 %	4 %	4 %	Nil	⅞ — 1	⅞ — ¾	..	..	— ⅛	Nil
96,000	Greenwood & Batley, 7 % Cum. Pref.	10	7 %	7 %	7 %	..	10½ — 10¾	10½ — 10¾	..	..	..	6 10 8
80,000	Do. do. 5 % Mort. Debs.	100	5 %	5 %	5 %	5 %	102 —106	103 —103½	..	..	..	4 16 10
40,000	Henley's (W. T.), Telegraph Works, Ord.	5	15%	15 %	15%	15 %	12 — 12⅜	12 — 12⅜	12⅛	12 7/16	..	5 17 8
40,000	Do. do. 4½ % Pref.	5	4½ %	4½ %	4½ %	4½ %	5⅜ — 5⅝	5 — 5⅛	..	..	— ⅛	4 3 9
150,000	Do. do. 4½ % Mort. Deb. Stock	Stock	4½ %	4½ %	4½ %	4½ %	104 —106	104 —106	..	..	..	4 4 11
50,000	India-Rubber, Gutta-percha & Telegraph Works..	10	10%	10 %	10 %	10 %	15⅞ — 16⅛	15⅞ — 16⅛	16 5/16	..	..	6 1 3
87,500	†Liverpool Overhead Railway, Ord.	10	Nil	Nil	⅛	Nil	3/32 — 5/32	3/32 — 5/32	..	..	..	Nil
10,000	† Do. do. Pref., fully paid ..	10	5 %	5 %	5 %	5 %	4⅜ — 5	4⅜ — 5	..	..	..	10 0 0
600,070	London United Trams. (1901), 1 to 60,007 ..	10	3 %	3 %	3 %	Nil	1½ — 2⅛	1⅛ — 2⅛	..	..	..	Nil
999,980	Do. do. 60,008 to 100,000	10	3 %	3 %	3 %	Nil	1⅛ — 2⅛	1⅛ — 2⅛	..	..	..	Nil
125,000	Do. do. 5 % Cum. Pref., 1 to 125,000	10	5 %	5 %	5 %	3½%	2¼ — 2⅜	2¼ — 2⅜	..	..	..	18 12 8
1,251,000	Do. do. 4 % 1st Mort. Deb. Stock ..	100	4 %	4 %	..	4 %	62 — 65	62 — 65	63½	63⅜	..	6 3 1
5,732,082	Metropolitan Consolidated	100	2½%	1 %	1½	¼%	38⅜ — 39⅛	38⅛ — 39	40⅛	39⅜	— ⅛	1 5 9
2,640,214	Do. Surplus Lands	100	2½%	2½%	2½%	2½%	66 — 67	66 — 68	67½	..	+1	4 0 11
2,295,000	Do. District	100	Nil	Nil	Nil	Nil	17⅛ — 17⅜	17⅜ — 18⅛	18⅛	17⅜	+1½	Nil
891,887	Metropolitan Electric Trams., Ord.	1	..	..	..	4½%	15/16 — 1 1/16	15/16 — 1 1/16	..	..	..	6 10 11
314,016	Do. do. Defd... ..	1	Nil	Nil	Nil	Nil	3/32 — 5/32	3/32 — 5/32	..	..	..	Nil
500,000	Do. do. 5 % Cum. Pref. ..	1	5 %	5 %	5 %	5 %	15/16 — 1	15/16 — 1 1/16	15/9	15/3	..	6 8 1
595,600	Do. do. 4½ % Deb. Stock Red.	100	4½%	4½%	4½%	4½%	93 — 96	93 — 96	95½	..	..	4 18 9
10,828,200	Mexico Trams Co., Common Stock	..	..	..	..	..	124 —126	123½ —125½	124 1/2	..	— ½	..
$9,000,000	Do. 1st Mort. 50-year 5% Gld. Bds.	..	..	..	..	5 %	91 — 93	91 — 93	94½	92	..	5 7 6
245,500	Potteries Electric Traction	1	4 %	4 %	4 %	Nil	1/32 — 3/32	1/32 — 3/32	..	..	..	..
245,500	Do. 5 % Cum. Pref.	1	5 %	5 %	5 %	5 %	1/32 — 3/32	1/32 — 3/32	10/6	10/3	..	6 17 11
245,000	Do. 4½ % Deb. Stock	100	4½%	4½%	4½%	4½%	84 — 87	84 — 87	..	..	..	5 3 6
87,850	Telegraph Construction and Maintenance	12	15 %	15 %	17½%	15 %	34½ — 36	34 — 35½	35	34½	— ½	5 4 6
140,000	Do. 4 % Deb. Bds., 1 to 1,500 Red., 1909	100	4 %	4 %	4 %	4 %	101 —103	101 —103	..	..	..	3 18 1
1,000,000	Underground Electric Railway, 5% Prior Lien ..	..	..	..	..	5 %	100 —101	100⅛ —101⅛	101	100½	+ ⅛	4 18 6
2,800,000	Do. do. 4½% Bonds	..	..	..	..	4½%	86 — 88	87 — 89	..	..	..	5 1 2
4,900,000	Do. do. 6% Income Bonds ..	..	..	..	..	..	30 — 32	32 — 34	33	32½	+1	..
66,666	Willans & Robinson, 1 to 80,000 & 80,001 to 116,666	5	Nil	Nil	10 %	5 %	⅛ — ¼	⅛ — ¼	..	..	+⅛	..
66,666	Do. 6 % C.P., 80,001 to 80,000 & 126,001 to 141,666	1	Nil	..	6 %	6 %	1½ — 2½	1½ — 2½	..	..	..	2 8 4
245,496	Do. % 1st Mort. Deb. Stock		4 %	4 %	4 %	4 %	72 — 77	72 — 77	..	..	..	5 1 3

ELECTRICITY SUPPLY COMPANIES.

15,000	Bromley (Kent) E.L. & P., 1 to 15,000		5½%	5½%	5½%	5½%	4½ — 4¾	4½ — 4¾	..	..	..	5 15 9
70,000	Do. do. 4½ % 1st. deb. stock ..	100	4½%	4½%	4½%	4½%	91 — 94	91 — 94	..	..	..	4 18 9
80,449	Brompton & Kens. Elec. Lt. Sup., Ord., 1 to 20,000	5	10 %	10%	10 %	10 %	7 — 7⅛	7 — 7⅛	7⅛	..	..	6 13 4
2,551	Do. do. 7 % Cum. Pref.	5	7 %	7 %	7 %	7 %	7 — 7⅛	7 — 7⅛	7 7/16	..	..	4 13 4
8 26,876	Central Electric Supply 4 % Guar. Deb. Stock ..	100	4 %	4 %	4 %	4 %	97 — 100	99 — 102	..	..	+2	3 18 5
80,000	Charing Cross and Strand Electricity Supply ..	5	5 %	5 %	5 %	5 %	3⅞ — 4⅛	3⅞ — 4⅛	..	..	..	6 17 8
80,000	Do. do. do. 4½ % Cum. Pref.	5	4½%	4½%	4½%	4½%	4⅛ — 4⅜	4⅛ — 4⅜	..	..	..	4 14 9
80,000	Do. "City Undertaking" 4½ % Cum. Prf.	5	4½%	4½%	4½%	4½%	3¾ — 4⅛	3¾ — 4⅛	..	..	..	5 6 11
445,736	Do. do. 4 % Deb. Stock Red. ..	100	4 %	4 %	4 %	4 %	98 — 101	98 —101	..	..	..	3 19 3
49,436	Chelsea Electricity Supply, Ord.	5	6 %	4½%	4½%	4½%	3⅝ — 3⅞	3⅝ — 3⅞	..	..	— ⅛	6 4 2
175,000	Do. do. 4½ % Deb. Stock Red. ..	Stock	4½%	4½%	4½%	4½%	100 —103	100 —103	100⅛	..	..	4 7 6
70,595	City of London Elec. Lighting, Ord. 40,001—110,595	10	6 %	6 %	6 %	6 %	10⅛ — 10⅜	10⅛ — 10⅜	10⅜	10 7/16	+ ⅛	5 11 8
40,000	Do. 6 % Cum. Pref., 1 to 40,000	10	6 %	6 %	6 %	6 %	11⅜ — 12⅜	11⅜ — 12⅜	..	..	..	4 12 4
400,000	Do. 5 % Db. Stk.	..	5 %	5 %	5 %	5 %	121 —124	121 —124	..	..	..	4 0 8
300,000	Do. 4½ % 2nd. Db. Stk.	100	4½%	4½%	4½%	4½%	100 —103	100 —103	..	..	..	4 7 5
50,000	County of Durham Electrical Power, Ord.	5	4 %	4 %	2 %	..	1⅛ — 2	1⅛ — 2	..	..	..	5 0 0
50,000	Do. do. do. 5 % Pref. ..	5	5 %	5 %	5 %	5 %	2⅛ — 3⅜	2⅛ — 3⅜	..	..	..	7 8 2
350,000	Do. do. do. 5 % 1st Mtg. Deb.	Stock	..	..	..	5 %	93⅜ — 95⅜	93⅜ — 95⅜	..	..	..	5 4 9
40,000	County of London Electric Lighting, Ord. 1—40,000	10	5 %	5 %	5 %	5 %	7⅛ — 8	7⅛ — 8	..	..	..	6 5 0
55,000	Do. do. 6 % Pref., 40,001—60,000	10	6 %	6 %	6 %	6 %	10⅜ — 11⅛	10⅜ — 11⅛	..	..	..	5 7 10
400,000	Do. do. 4½ % Deb. Stock ..	..	4½%	4½%	4½%	4½%	105 —108	105 —108	105⅜	..	..	4 3 4
400,000	Do. do. 4½ % 2nd. Deb. Stock ..	Stock	4½%	4½%	4½%	4½%	99 —101	98 —101	..	..	..	4 9 1
80,000	Edmundson's Electric Corporation, Ord. Shares ..	5	4 %	Nil	Nil	Nil	1/32 — 3/32	1/32 — 3/32	..	..	..	Nil
80,000	Do. do. 5 % Cum. Pref.	5	6 %	8 %	Nil	Nil	1/32 — 1/16	3/32 — 1/16	10/7½	..	+ ⅛	Nil
480,500	Do. do. 4½ % 1st Mort. Deb. Stk.	100	4½%	4½%	4½%	4½%	57 — 60	57 — 60	..	..	..	7 10 0
$3,150,000	Electrical Dev.Co.of Ontario, 5% 1stMtg.Gold Bnds.	$500	..	..	..	5 %	91 — 94	91 — 94	..	..	..	5 6 5
10,000	Folkestone, 1 to 10,000	5	5½%	5½%	5½%	5½%	4⅜ — 4⅞	4⅜ — 4⅞	..	..	..	5 12 10
10,000	Do. 5 % Cum. Pref., 1 to 10,000	5	5 %	5 %	5 %	5 %	4⅛ — 5⅜	4⅛ — 5⅜	..	..	..	4 13 0
90,000	Do. 4½ % 1st Deb. Stock	100	4½%	4½%	4½%	4½%	97 —100	97 —100	..	..	..	4 10 0
15,000	Hove, 1 to 15,000	5	9 %	9 %	8½%	8½%	6⅞ — 7⅛	6⅞ — 7⅛	..	..	..	5 13 4
$1,876,000	Kaministiquia Power Co., 5 % Gold Bnds.	..	..	..	..	5 %	101 —103	101 —103	102½	..	..	4 17 1
21,000	Kensington and Knightsbridge Electric Ord. ..	5	10 %	10 %	10 %	8 %	7 — 7⅛	7 — 7⅛	..	..	..	5 4 1
90,000	Do. do. do. 4 % Deben. Stk.	Stock	4 %	4 %	4 %	4 %	95 — 98	95 — 98	..	..	..	4 1 8
111,000	London Electric Supply Corporation, Limited, Ord.	3	4 %	4 %	2½%	3 %	1⅝ — 2	1⅝ — 2	..	..	..	4 8 11
70,000	Do. do. do 6 % Pref. ..	5	6 %	6 %	6 %	6 %	4½ — 5⅛	4½ — 5⅛	..	..	..	5 17 1
382,355	Do. do. 4 % 1st Mort. Deb. Stk. Red.	Stock	4 %	4½%	4½%	4 %	92 — 95	92 — 95	..	..	..	4 4 8
300,000	Metropolitan Electric Supply, 1 to 100,000	5	10 %	5 %	6½%	5 %	3⅞ — 4⅛	3⅞ — 4⅛	83/1½	80/-	+ ⅛	5 14 3
76,121	Do. 4½ % Cum. Pref. 1—71,106	5	4½%	4½%	4½%	4½%	4⅝ — 5	4⅝ — 5	..	..	..	4 10 0
285,000	Do. 4½ % 1st Mort. Deben. Stock ..	..	4½%	4½%	4½%	4½%	108 —109	106 —109	..	..	..	4 2 7
248,000	Do. 3½ % Mort. Deben. Stock Redem.	Stock	3½%	3½%	3½%	3½%	83½ — 86½	83½ — 86½	..	..	..	4 0 11
$ 1,000,000	Mexican Electric Light Co., 5% 1st Mtg. Gold Bnds	..	5 %	5 %	5 %	5 %	81 — 83	81 — 83	82	..	..	6 0 6
8,585,000	Do. Light and Power Co., Ltd., Common ..	$100	..	..	..	3½%	69 — 71	69¼ — 71¼	70½	..	+ ⅛	4 17 11
$ 1,400,000	Do. do. 7% Cum. Pref. Stk.	Stock	..	..	..	7 %	101 —105	101 —105	103	101½	..	6 13 4
$ 19,000,000	Do. do. 5% 1st Mtg. Gold Bnds.	..	..	..	..	5 %	85 — 87	86 — 87	8 3/2	85	..	5 14 11
250,000	Midland Electric Corporation, 4½ % 1st Mort. Deb.	100	4½%	4½%	4½%	4½%	98 — 100	98 — 100	..	..	..	4 10 0
120,491	Newcastle-on-Tyne, 1 to 127,500	5	3 %	3 %	3 %	2½%	4 — 4¼	4 — 4¼	..	..	..	2 15 1
127,500	Do. 5 % Pref., 1 to 127,500	5	5 %	5 %	5 %	5 %	4 — 4¼	4 — 4¼	..	..	..	5 10 2
126,500	{North Metropolitan Electric Power Supply Co.,} {5 % Mortgages (Red.), Nos. 1 to 1,265}	100	..	..	..	..	98 —100	93 — 100	..	..	..	..
10,853	Notting Hill Electric Lighting	10	7½%	7½%	7½%	7 %	12½ — 13½	12⅞ — 13½	..	..	..	5 6 0
20,000	Oxford, 1 to 96 and 407 to 20,319	5	7 %	7 %	7 %	..	6 — 6½	6 — 6½	..	..	..	5 7 9
50,000	Do. 4 % Deb. Stock	100	4 %	4 %	4 %	4 %	95 — 98	95 — 98	..	..	..	4 1 8
119,694	River Plate Electy. Co. Ord. Nos. 1 to 120,507 ..	1	..	9½%	6 %	8 %	1⅛ — 1⅜	1⅛ — 1⅜	..	..	..	4 18 6
100,000	Do. do. 8% Non Cum. Pref. Nos. 1 to 100,000	1	6 %	6 %	6 %	6 %	1 3/32 — 1 5/32	1 3/32 — 1 5/32	..	..	..	5 19 9
300,000	Do. do. 5% Deb. Stk. Red.	100	5 %	5 %	5 %	5 %	103 —106	103 —106	..	..	..	4 14 4
40,000	St. James' and Pall Mall Electric Light, Ord. ..	5	12½%	10 %	10 %	10 %	8¾ — 9	8¾ — 9	..	..	..	6 7 0
90,000	Do. do. 7 % Pref. 80,001 to 40,000	5	7 %	7 %	7 %	7 %	7 — 7½	7 — 7½	..	..	..	5 11 1
152,000	Do. do. 5½ % Deb. Stock Red. ..	100	5 %	5½%	5½%	5½%	84 — 88	84 — 88	..	..	..	5 19 7
12,000	Smithfield Markets Electric Supply, Ord.	5	4 %	Nil	Nil	Nil	1⅛ — 2 1/16	1⅝ — 2⅛	40/-	..	— ½	Nil
66,000	South London Electric Supply, Ord.	4	4 %	8 %	4 %	5 %	2⅝ — 3	2⅝ — 3	..	..	..	6 13 4
122,000	South Met. Elec. Lt. & Power, Ord.	1	2½%	2½%	2½%	2½%	15/16 — 1	15/16 — 1	..	..	..	4 8 11
142,963	Do. do. 7 % Pref.	1	7 %	7 %	7 %	7 %	1 1/16 — 1 1/8	1 1/16 — 1 1/8	..	..	..	5 17 11
224,532	Do. do. 4½ % 1st Deb. Stk.	100	4½%	4½%	4½%	4½%	100 —103	100 —103	..	..	..	4 7 5
80,000	Urban Electric Supply, Ord.	5	5 %	5 %	5 %	5 %	⅝ — ¾	⅝ — ¾	..	..	..	25 6 8
50,000	Do. do. 5 % Cum. Pref.	5	5 %	5 %	5 %	5 %	1⅜ — 1⅝	1⅜ — 1⅝	..	..	..	14 5 4
275,000	Do. do. 4½ % 1st Mort. Db. Stk. Red.	100	4½%	4½%	4½%	4½%	74½ — 78½	74½ — 78½	..	..	..	5 14 3
303,000	Victoria Falls Power Co., Pref. Nos. 1 to 303,000 ..	1	..	..	..	5 %	⅝ — ¾	⅝ — ¾	..	..	..	5 6 8
110,000	Westminster Electric Supply, Ord.	5	12 %	12 %	10 %	10 %	8⅝ — 8¾	8⅝ — 8¾	8⅝	..	..	5 12 8
81,379	Do. do. 4½ % Cum. Pref. Reduced from 5% since 31st Dec., 1905)	5	5 %	4½%	4½%	4½%	5 — 5⅛	5 — 5⅛	5⅛	5 1/16	..	4 1 10

* Unless otherwise stated, all shares are fully paid. † Quotations on Liverpool Stock Exchange.

Bank rate of Discount 4½ per cent., December 9th, 1909.

ELECTRIC TRAMWAY COSTING AND STATISTICS.

[COMMUNICATED.]

(*Concluded from page* 953.)

THE introductory page deals with the revenue receipts and expenditure, the second page with the revenue expenditure in detail, both for the same period, and the final page with statistics. The receipts are abstracted daily from the way bills into the Traffic Summary book, which is in the usual form, and from which a daily return (Schedule 10) is

Schedule 10.

Daily Return of Receipts for.....19 .

Below are particulars of receipts for the above date. I have to-day paid into the ..... Bank to the credit of the Company £.....

State of weather.....

State of weather corresponding day of previous year .....

.....Date. .....Manager.

Route.	Total Receipts.	Receipts per car-mile.	No. of cars.	Miles run.	Total No. of passengers.	Remarks.
TRAFFIC RECEIPTS.						
SUNDRY RECEIPTS.						
Total ..						
Corresponding day of previous year						
Increase / Decrease						

prepared of the receipts taken and the amount paid into the bank, for the information of the head office. The payments into the bank of traffic receipts are debited in the cash book from this return, the entries being posted to the credit of a traffic receipts account. All receipts are banked, and any difference that there may be at any time between the sum banked and the sum received, is accountable for by the traffic manager. A weekly return of receipts may be prepared in the form of Schedule 11.

Schedule 11.

Statement of Receipts for the week ended.....19 .

Route.	For corresponding period of previous year.				For week ended				Increase.				Decrease.			
	Amount	Per car-mile.	Route mileage.	Per passenger.	Amount.	Per car-mile.	Route mileage.	Per passenger.	Amount.	Per car-mile.	Route mileage.	Per passenger.	Amount	Per car-mile.	Route mileage.	Per passenger.
TRAFFIC RECEIPTS																
SUNDRY RECEIPTS																
Total ..																

State of weather—This year.....

Last year.....

.....

It will be seen that a column is provided in each of the statements—viz., stores, wages and salaries—for allocations to capital. Petty cash is similarly treated. Details of the capital expenditure included in the schedules are furnished in the form given in Schedule 12.

In the case of an undertaking which generates its own current, a statement of power-station statistics and generation costs may be prepared in accordance with

Schedule 12.

Details and appropriations of Stores charged to Capital for the ended.....19 .

Date.	Details of issues and work done.	Capital Account to be charged.	

SUMMARY OF CAPITAL EXPENDITURE.

(Accounts to be debited.)

	£
Power house buildings	
Other buildings	
Permanent way	
Cars and car equipments	
Engines and boilers	
Dynamos, exciters, &c.	
Other machinery, instruments, &c. ...	
Accumulators	
&c., &c.	
Total as per details above	

Similar statements are provided in respect of Wages, Salaries, and Petty Cash.

Schedule 13, the method of preparation being similar to that already described. In the case of a combined undertaking—*i.e.*, tramways and lighting—the accounts of the tramway and lighting sections must be kept distinctly. Where there is no public or private lighting the cost of generation is practically the cost of the current supply to the

Schedule 13.

POWER-STATION STATISTICS AND GENERATION COSTS.

For the ended .....

(1) POWER-STATION STATISTICS.

1. Plant installed ... ... KW.
2. Condensing, partially condensing, or non-condensing
3. Maximum demand on power station ... ... KW.
4. Station load factor $\frac{\text{Units generated} \times 100}{\text{Capacity of power station in KW.} \times 24 \times \text{number of days represented by the return}}$ ... %
5. Running plant load factor $\frac{\text{Units generated} \times 100}{\text{Capacity of plant run in KW.} \times \text{hours run}}$ ... %
6. Price of coal or other fuel delivered ... ...
7. Number of pounds of fuel per unit generated ...
8. Units:—
   - I. Generated ... ...
   - II. Used in station ... ...
   - III. Sent out ... ...

Schedule 13.

(2) GENERATION COSTS.

Description.	Amount.	Total.	Per unit generated. This year.	Per unit generated. Last year.	Per unit sent out. This year.	Per unit sent out. Last year.	Remarks.
Coal or other fuel							
Oil, waste, water and engine room stores							
Wages							
Salaries							
Repairs and maintenance—							
Power station buildings wages ..							
materials							
Engines and boilers wages ..							
materials							
Dynamos, exciters, &c. wages ..							
materials							
Other machinery, instruments wages							
materials							
Accumulators, &c. wages ..							
materials							
Sundries							
Total							

undertaking. It will be seen that the cost statement is of a continuous nature, and that subject to any necessary adjustments it should agree fairly closely with the actual profit and loss of the undertaking for the financial year. There may be

of course an odd number of days or weeks at the end of the year for which a return will be necessary. In the event, however, of an undertaking combining the simultaneous characteristics of promotion, construction and running or operation, as it often does, there is frequently much expenditure, the allocation of which is not determined, and much that is not ascertainable until after the termination of the year, and to that extent, at any rate, the profit and loss account in such cases will differ from the Cost Returns. Expenditure and Income may be plotted in the form of a graph, and though it may be nice, it is only of theoretical importance and hardly worth the labour which its preparation involves.

Such costing and statistics are frequently of assistance, directly, or indirectly, in the consideration of proposals submitted from time to time, which have for their object the establishment of electric tramway systems, and it may be interesting to notice briefly some of the investigation and promotion considerations which precede the creation and consequent inauguration of electric tramway undertakings. That there is but little new tramway ground to prospect in this country is readily admitted, with the result that some promoters of tramways have turned their attention abroad in search of pastures new for the purpose of exploiting the *prima facie* objects of the undertakings with which they claim association, whilst others have in view possibly not so much tramway enterprise as the necessity for creating promotion profits, with a view to the restoration and display of attractive credit balances on revenue account.

Population and Passenger Traffic.

One of the primary factors which may be considered under this sub-title is the number of passengers that are likely to be carried on the lines proposed. Premising that the population of our hypothetical scene of operation numbers 100,000 inhabitants, we may obtain some guidance from the experience of existing undertakings, and with a view to adopting such experience, select a number of instances containing as nearly as possible the elements of similarity of population to be served, as well as of general conditions, or we may take a larger number of instances of a promiscuous nature, with varying, and in some particulars little, semblance of similarity, and reduce them to a comparative denominator, which obviously, however, will not enable us to arrive at a result as reliable as the former, though it may be sufficiently accurate for all practical purposes. We may proceed thus :—

$$\frac{\text{No. of passengers carried in each year}}{\text{Population}} = \text{No. carried per capita of population,}$$

and if we feel inclined to compute the mean of, say, half-a-dozen instances, letting each instance be denoted by a_1, a_2, and so on, we may do so by—

$$\sqrt[6]{(a_1 \times a_2 \ . \ . \ . \times a_6)}.$$

To arrive at a still more reliable estimate we may of course take the mean of each selected instance over a corresponding number of years, and the final mean of the ascertained results.

This figure representing per capita of population having been carefully extracted, let it be 50, and the town being one of 100,000 inhabitants, we should be reasonable in asserting that the probable number of passengers per annum would be 5,000,000, viz. (100,000 × 50).

Car-Miles.

The next convenient matter is that of car-miles, and here, *inter alia*, some of the governing incidental considerations are: (*a*) location and distribution of population; (*b*) service to be rendered; (*c*) mileage of routes; (*d*) speed of cars; (*e*) daily working hours. Let us assign to (*b*), (*c*), (*d*) and (*e*) the following data, viz., 10 minutes, 12 route miles, 10 miles an hour and 16 hours respectively.

A speed of 10 miles an hour means that the outward and return journeys of 24 miles would occupy 2·40 hours or 160 minutes, and a 10-minute service would require the daily use of, say, 16 cars (160 ÷ 10). With the aid of these figures of 16 cars, 12 route-miles and 16 daily operating hours, we obtain the number of car-miles per diem, which is 3,072 (16 × 12 × 16), and multiplying this number by 365, we are in possession of 1,121,280 car-miles per annum. On the other hand, we may extract, in the manner described in the previous section, from our selected instances the number of car-miles run per capita of population, and adopt the mean of the two methods. That is to say—

$$\sqrt[2]{\text{Car-miles obtained per capita of population.} \times \text{Car-miles obtained by number of cars in daily use × route mileage × number of daily operating hours × number of days per annum.}}$$

Annual Earnings.

The annual revenue may be estimated by (*a*) taking from each selected instance the average fare per passenger carried in each year over a specific number of years, then the mean of the years, of each instance, and finally the mean of all the instances chosen, viz.: Supposing three instances over a period of three years, *a*, *b* and *c*. Now, the mean in instance *a* is—

$$\frac{\text{Passenger earnings}}{\text{Total No. of passengers carried}} = \text{Average earnings per passenger carried.}$$

Let the average earnings per passenger carried be represented by *r*, then we have as the mean of instance *a* for a period of three years—

$$\sqrt[3]{r \times r \times r}.$$

And, finally, let the mean of each instance over a period of three years be denoted by *s*, we have as the mean of all the instances—

$$\sqrt[3]{s \times s \times s}.$$

We thus arrive at the estimated receipts per passenger and multiplying the figure which we may assume for the purpose of our illustration as 1·15d. by the estimated number of passengers, we arrive at our calculated annual revenue from the conveyance of passengers, viz.: £23,958 6s. 8d., say, £24,000.

(*b*) In a similar manner we may exercise a check upon this result by dividing into the passenger earnings the number of car-miles which will afford us the earnings per car-mile, which, multiplied by the estimated number of car-miles, provides the probable yearly revenue from passenger transport only, *i.e.*, exclusive of receipts from potential parcels traffic and other sources.

Annual Revenue Expenditure.

We can base, of course, our estimate upon the experience of similar undertakings, or we may enter into detail and compute the local salaries, wages of conductors and motormen, inspectors, storekeepers, power station staff, repairs and maintenance, and other inevitable items of expenditure of tramway undertakings, not omitting such head office charges as directors' fees, rents, salaries, &c., and any periodical sums which may be payable to the Government or the municipality under the contemplated concession, and last, but not least, in many cases the exchanges. For all practical purposes, however, we shall find that a percentage of tramway receipts will be sufficiently accurate, and this ratio we may take for the purpose of our illustration as, say, 60 per cent.

Capital or Construction Expenditure.

This is a matter entirely for the engineer, who will be required to take into consideration physical conditions, cost of materials and labour, Customs duties, and many other points which will arise in the course of preparing the data for his estimate. With the view of completing our illustration, however, we shall assume that our hypothetical system of 12 route miles is partly of single and partly of double track, and that the estimated cost, including power station, car-sheds, cars, &c., is, say, £11,000 per route-mile, which will make the initial cost of construction and equipment £132,000. Adding to this sum, say, £5,000 for preliminary expenses, our capital expenditure may be expressed as £137,000.

Assembling the results at which we have arrived, we have—

(*a*) Estimated annual income, say		£24,000
(*b*) Estimated annual expenditure, 60 per cent. of (*a*)		14,400
		£9,600
Depreciation, ½ l. per car-mile on 1,121,280 car-miles	£2,336	
5 per cent. on capital	6,850	
Carry forward	414	
		£9,600

The depreciation allowance is, of course, insufficient, whilst the 5 per cent. return is but a miserable yield if the capital takes the form of the ordinary or preference description, and consequently the carry forward is paltry.

There are at least two points to bear in mind as between the lessor and lessees, the description of which should be free from ambiguity in the concession. They are (1) adequate provision for depreciation on the part of the lessees in addition to ordinary repairs and maintenance, and (2) if the undertaking may be taken over as a going concern, it should be expressly stipulated in the concession that the liabilities will be borne by the lessors, inasmuch as they are included in the assets whose value will be paid for in the valuation. If such a stipulation be omitted, the probability is that the authority will have to pay the liabilities as well as the agreed amount for the assets.

Where no reasonably comparative instances are available the estimate naturally will be much more approximate in its results; but on the lines indicated it can, with such other considerations as a local study of each proposition suggests to the experienced investigator or prospector, be framed with such an approach to safety as will be sufficient to enable at any rate a fairly accurate opinion to be expressed upon it.

The average earnings per passenger or per car-mile of foreign undertakings are productive of much variety. For the year 1907 the earnings of that ably managed undertaking, the Lisbon Electric Tramways, Ltd., consisting of traffic and sundry receipts, but excluding revenue derived from investments, transfer fees, &c., exceeded 1,472 contos of reis, which at par gives, roughly, an average of 1·77 per passenger carried. A slight reduction, however, is necessary in making allowance for the exchange at the rate of valuation adopted for the conversion of the currency credit balance of the local profit and loss account. After deducting Lisbon working expenses, amount payable to the Camara de Lisboa, and expenditure under the lease from the Companhia Carros de Ferro de Lisboa, from whom the present company leases the undertaking, which includes interest and amortisation due on the debentures of that company, there is a credit balance on the local profit and loss account of 552,560·993 rs., which at par gives approximately a little over 7d. as the average receita por trem kilometro.

With regard to the undertaking of the Companhia Carros de Ferro do Porto (Sociedade Anonyma de Responsabilidade Limitada), which is owned locally, the receitas de exploracao —that is, tramway receipts proper—excluding dividendo de accoes em carteira and materiaes vendidos, amounted to 449:182$444 for the same year, which, with the income from the two sources named, make a total of 452 : 643$524. Os resultados da exploracao na Antiga rede e na Linha de Gaya give about 172 rs. as the recita por trem kilometro. In analysing the expenses and other details of this undertaking, however, the Ganhos e Perdas requires some adjustment. For instance, the receita liquida em 1907 must be omitted, which is merely the difference between the receitas de exploracao and despezas de exploracao, and substitute therefor 449 : 182$444 as already indicated, whilst on the deve side to the individual despezas shown must be added the despezas de exploracao, &c.

A statistic that is sometimes useful for check and comparative purposes is the average receipt per car per day. It is sometimes calculated by dividing into the average receipts per day for the period the result of car-hours divided by operating hours.

Bishop's Stortford Electric Lighting.—The U.D.C. is applying for powers to purchase the Bishop's Stortford and District Gas Co.'s undertaking; also for an extension of time for laying electric light mains under 1905 order.

THE LOADING OF TELEPHONE CABLE CIRCUITS.*

By A. W. MARTIN.

(*Continued from page* 955.)

It is well known that in any circuit where the impressed voltage is periodic, and a simple harmonic, if v represent the instantaneous value of the voltage after time t, and if v_m represent the maximum value to which the voltage rises, then—

$$v = v_m \sin pt,$$

and
$$\frac{dv}{dt} = p\, v_m \cos pt,$$

but
$$p\, v_m \cos pt = p\, v_m \sin (90 + pt),$$
$$= ip\, v_m \sin pt,$$
$$= ip\, v,$$

where i represents $\sqrt{-1}$ and indicates the rotation of the quantity to which it is attached through 90°. So that—

$$\frac{dv}{dt} = ipv.$$

Similarly it may be shown that—

$$\frac{dc}{dt} = ipc.$$

Inserting these values in the equations (1) and (2) for $\frac{dv}{dx}$ and $\frac{dc}{dx}$ respectively—

$$\frac{dv}{dx} = cR + ipLc,$$

$$\frac{dc}{dx} = vS + ipKv,$$

or,
$$\frac{dv}{dx} = (R + ipL)\, c, \quad . \quad . \quad . \quad . \quad (3)$$

$$\frac{dc}{dx} = (S + ipK)\, v. \quad . \quad . \quad . \quad . \quad (4)$$

The quantity $R + ipL$ is an *impedance*, and if, as stated above, i indicates the rotation of magnitude through 90°, then the expression may be represented by a right-angled triangle as shown in fig. 5, where I denotes impedance; so that—

$$I = R + ipL.$$

or
$$I = \sqrt{R^2 + p^2 L^2}.$$

The quantity $S + ipK$ is the reciprocal of an impedance, and is called the *admittance*. It also may be represented by

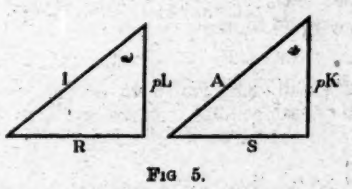


Fig 5.

a right-angled triangle, as shown to the right in fig. 5, where it is indicated by A. In this case—

$$A = S + ipK,$$

or
$$A = \sqrt{S^2 + p^2 K^2}.$$

Putting
$$I = R + ipL,$$

and
$$A = S + ipK$$

in the equations (3) and (4)—

$$\frac{dv}{dx} = Ic, \quad . \quad . \quad . \quad . \quad . \quad . \quad . \quad (5)$$

and
$$\frac{dc}{dx} = Av. \quad . \quad . \quad . \quad . \quad . \quad . \quad . \quad (6)$$

* A paper read before the Institution of Post Office Electrical Engineers on January 11th and February 8th, 1909.

These equations, (5) and (6), show, for any element of the loop, how the difference of potential between the wires varies, and how the current strength changes. To determine how the voltage and current strength vary with the distance from one end of the circuit, it is necessary to differentiate again with respect to distance. It will be convenient to take any distance, x, from the receiving end of the circuit—say, that shown in fig. 2—because, as this distance increases, both voltage and current strength increase, and the use of negative signs is avoided. Thus—

$$\frac{d^2 \mathrm{V}}{dx^2} = \mathrm{I} \frac{d \mathrm{C}}{dx},$$

$$\text{and} \quad \frac{d^2 \mathrm{C}}{dx^2} = \mathrm{A} \frac{d \mathrm{V}}{dx}.$$

Inserting the values for $\frac{d \mathrm{V}}{dx}$ and $\frac{d \mathrm{C}}{dx}$ shown in equations (5) and (6)—

$$\frac{d^2 \mathrm{V}}{dx^2} = \mathrm{I A V},$$

$$\frac{d^2 \mathrm{C}}{dx^2} = \mathrm{I A C}.$$

Let $\mathrm{I A} = a^2$,

$$\text{then} \quad \frac{d^2 \mathrm{V}}{dx^2} = a^2 \mathrm{V},$$

$$\text{and} \quad \frac{d^2 \mathrm{C}}{dx^2} = a^2 \mathrm{C}.$$

Both of these equations are of the form—

$$\frac{d^2 y}{dx^2} = a^2 y,$$

and from earlier considerations it is concluded that the solutions are—

$$\mathrm{V} = \mathrm{M} e^{ax} - \mathrm{N} e^{-ax},$$

$$\mathrm{C} = \mathrm{M} e^{-ax} - \mathrm{N} e^{-ax}.$$

As both V and C vary in the same way, it is only necessary to consider one of them. Let it be V.

Taking a particular point in the circuit, it will be seen that the nearer it is to the *sending* end, or the greater x becomes, the greater will be the term $\mathrm{M} e^{ax}$, and the less will be $\mathrm{N} e^{-ax}$. The latter term, in fact, represents the reflected wave or impulse from the receiving end. It will be assumed that x is so great that $\mathrm{N} e^{-ax}$ becomes negligible or, in the alternative, that there is no reflection; in which case—

$$\mathrm{V} = \mathrm{M} e^{ax}.$$

All the following results will, therefore, be understood to apply only to the case where the whole energy received at the end of the circuit is absorbed. In Part II will be found the description of a means of practically determining what is lost by terminal reflections, &c.

The distance x has been taken as that between the element under consideration and the receiving end of the circuit. To express the results, already obtained, in terms of the distance from the sending end, it is only necessary to put $x = m - d$ where—

m = total length of circuit in miles,

d = distance of the point from sending end, in miles.

Taking $\mathrm{V} = \mathrm{M} e^{ax}$,

then $\mathrm{V} = \mathrm{M} e^{a(m-d)}$,

$= \mathrm{M} e^{am} . e^{-ad}$.

Now, at the sending end itself, $d = 0$, so that V then equals $\mathrm{M} e^{am}$. In other words, $\mathrm{M} e^{am}$ is the voltage at the sending end. Let this be represented by V_0; then—

$$\mathrm{V} = \mathrm{V}_0 e^{-ad} \quad . \quad . \quad . \quad . \quad . \quad . \quad . \quad (7)$$

It has been stated that $a^2 = \mathrm{I A}$, so, therefore, $a = \sqrt{\mathrm{I A}}$. But any quantity such as a^2 may be written equal to the sum of two other squares; thus—

$$a^2 = \beta^2 + \alpha^2 = \mathrm{I A},$$

and since α is at right angles to β,

$$a = \beta + i\alpha.$$

Inserting this value for a in equation (7)—

$$\mathrm{V} = \mathrm{V}_0 e^{-(\beta + i\alpha)d},$$

$$= \mathrm{V}_0 e^{-\beta d} . e^{-i\alpha d} \quad . \quad . \quad . \quad (8)$$

The factor $e^{-\beta d}$ represents a decaying quantity, and indicates the way in which the difference of potential between the wires of the loop decreases with the distance d from the sending end; but $e^{-i\alpha d}$ is of a different nature. By De Moivre's theorem—

$$e^{-i\alpha d} = \cos \alpha d - i \sin \alpha d,$$

so that $\mathrm{V} = \mathrm{V}_0 e^{-\beta d}(\cos \alpha d - i \sin \alpha d)$.

It is known that any quantity multiplied by $\cos \alpha d + i \sin \alpha d$ is advanced by an angle αd in a positive direction, and that one multiplied by $\cos \alpha d - i \sin \alpha d$ is retarded or turned through an angle αd in a negative direction. The meaning of $\mathrm{V} = \mathrm{V}_0 e^{-\beta d} (\cos \alpha d - i \sin \alpha d)$ is, therefore, that the difference of potential, V, between the wires of the loop at distance d from the sending end is $\mathrm{V}_0 e^{-\beta d}$ where V_0 is the difference of potential at the sending end; and V lags behind V_0 by an angle αd.

It is scarcely necessary to emphasise the fact that the greater the distance d, the greater will be the lag. It will also be clear that, as the distance from the sending end is increased, a point will be reached at which the voltage between the wires is one complete cycle or period behind that impressed at the sending end. Now, from the fact that the phase changes uniformly with the distance, it follows that the waves are travelling along the circuit with a constant velocity, and if at distance d the phase has been delayed by one period, then—

$$\alpha d = 2\pi,$$

$$\text{and} \quad d = \frac{2\pi}{\alpha}.$$

Suppose that f complete periods have been passed through by the E.M.F. at the sending end, then $f - 1$ periods will have been passed through by the difference of potential at the distance d where the phase is one cycle in arrear. Obviously, the time taken for a wave to reach the point at distance d is the same as that occupied by one period. The velocity, v, of the waves is, therefore, shown by—

$$v = \frac{d}{t} = \frac{\frac{2\pi}{\alpha}}{t},$$

where t is the time of one period. If there be f periods per second, then $t = \frac{1}{f}$.

$$\text{So that} \quad v = \frac{\frac{2\pi}{\alpha}}{\frac{1}{f}} = \frac{2\pi f}{\alpha},$$

$$\text{also wave length} = \lambda = \frac{\text{velocity}}{\text{periodicity}},$$

$$\lambda = \frac{\frac{2\pi f}{\alpha}}{f} = \frac{2\pi}{\alpha}.$$

From the immediately preceding consideration, it will be gathered that α is a constant which determines the velocity with which the waves travel along the circuit, and from equation (8) it will be seen that β is a constant determining the attenuation of the waves at any distance d from the sending end.

α is therefore called the velocity constant.

β „ „ attenuation „

It has been stated that—

$$a^2 = \beta^2 + \alpha^2 = \mathrm{I A},$$

where $\mathrm{I} = \sqrt{\mathrm{R}^2 + p^2 \mathrm{L}^2}$,

and $\mathrm{A} = \sqrt{\mathrm{S}^2 + p^2 \mathrm{K}^2}$,

therefore $\beta^2 + \alpha^2 = \sqrt{(\mathrm{R}^2 + p^2 \mathrm{L}^2)(\mathrm{S}^2 + p^2 \mathrm{K}^2)}$. . . . (9)

Also $$a = \beta + i\alpha = \sqrt{\text{I A}},$$
$$a^2 = \beta^2 - \alpha^2 + 2i\alpha\beta = \text{I A},$$

where $$\text{I} = \text{R} + ip\text{L},$$

and $$\text{A} = \text{S} + ip\text{K},$$

therefore, $$\beta^2 - \alpha^2 + 2i\alpha\beta = (\text{R} + ip\text{L})(\text{S} + ip\text{K}),$$
$$= \text{R S} - p^2\text{L K} + ip(\text{K R} + \text{S L}).$$

In an equation like this, the real and unreal quantities on the one side are equal to the real and unreal on the other, respectively; so that—

$$\beta^2 - \alpha^2 = \text{R S} - p^2\text{L K}. \quad . \quad . \quad . \quad . \quad . \quad . \quad . \quad (10)$$

By subtracting equation (10) from (9)—

$$2\alpha^2 = \sqrt{(\text{R}^2 + p^2\text{L}^2)(\text{S}^2 + p^2\text{K}^2)} - (\text{R S} - p^2\text{L K}),$$

$$\alpha = \sqrt{\tfrac{1}{2}\left[\sqrt{(\text{R}^2 + p^2\text{L}^2)(\text{S}^2 + p^2\text{K}^2)} - (\text{R S} - p^2\text{L K})\right]}, \quad (11)$$

which is the expression for the velocity constant.

By adding together equations (9) and (10)—

$$2\beta^2 = \sqrt{(\text{R}^2 + p^2\text{L}^2)(\text{S}^2 + p^2\text{K}^2)} + (\text{R S} - p^2\text{L K}),$$

$$\beta = \sqrt{\tfrac{1}{2}\left[\sqrt{(\text{R}^2 + p^2\text{L}^2)(\text{S}^2 + p^2\text{K}^2)} + (\text{R S} - p^2\text{L K})\right]}, \quad (12)$$

which is the expression for the attenuation constant.

These expressions for the velocity and attenuation constants were given by Mr. Oliver Heaviside; see page 400, Vol. II, "Electrical Papers," Macmillan, 1892.

(*To be continued.*)

PROCEEDINGS OF INSTITUTIONS.

Recent Developments in the Transmission of Electrical Energy.

By Prof. E. W. Marchant, D.Sc., Member, and E. A. Watson, M.Sc., Student.

(*Abstract of paper read before the* Institution of Electrical Engineers *at Manchester, November 30th*, 1909.)

(*Concluded from page* 958.)

Economic Limits of Transmission.

The capital charges in connection with hydro-electric schemes are by far the most important in determining the cost of generating energy. The running charges are invariably low. In the Ontario Power Co.'s station at Niagara the whole plant of 50,000 kw. was in charge of three men and two switchboard operators. At Niagara, although the problem of conveying the water to the station only involves the boring of a short tunnel, and the plant capacity is large, the cost was given at from £20 to £30 per kw., including the transmission line; it was a good deal higher for the older stations where an expensive type of machine with a shaft 130 ft. long between turbine and generator had been installed. The lowest figure for capital expenditure, including transmission line, was £15 per kw. The charge for the transmission line is usually a very serious matter. The Ontario Electric Development Co., for example, sell their energy at Niagara for less than half of what they charge for it at Toronto.

One of the most interesting points about the transmission line is the determination of the most economical voltage at which it should be worked. Kelvin's law is based on the condition that the total charge for transmitting energy along the line shall be a minimum, but a sounder condition to apply to a transmission line is that the ratio of the total cost of transmitting energy to the revenue earned shall be a minimum, and if this condition is applied we find that the cost of wasted energy must be equal to the whole charge for interest and depreciation on the transmission line. If we assume a cost for the station of £30 per kw., a load factor of 50 per cent., and interest and depreciation charges 12½ per cent., the cost per B.T.U. will be 0·261. On a 20,000-kw. transmission, allowing 10 per cent. copper drop, the cost of waste energy will correspond with a capital charge of £120,000, if 15 per cent. is allowed for interest and depreciation on the line, or a capital charge of £800 per mile. The cost of poles and insulators on an 8,000-volt line will be about £200 per mile, and the balance will pay for a three-wire line, each conductor of which is 0·30 sq. in. in area. This corresponds fairly closely with the actual section necessary to give a 10 per cent. drop—*i.e.*, 0·35 in. of copper. The calculation shows that the use of these voltages is economically sound, and that for a transmission of 200 miles and over, a pressure of the order of 100,000 volts must be employed.

The second factor which determines the size of the conductor is the working pressure. With the high pressures used (as is shown above) the possibility of the formation of a corona and the loss of considerable energy by a brush discharge is one that requires careful consideration, and it would be impossible to reduce the section of the conductor used for the transmission below that for which such effects are produced. The cost of insulators is a comparatively small item in the total cost of a pole-line, and the working voltage is settled by the economic considerations detailed above. The common practice is to work the line to give a known percentage drop, and to increase the voltage on the line as the load on it increases, until at the full load the pressure on the line is the maximum for which it was designed at a predetermined drop. The usual efficiency of transmission on most of the schemes seems to be about 90 per cent., the copper drop being of the order of 10 per cent., and the total drop due to resistance and inductance about 15 per cent.

Modern Practice (Hydro-electric Plants Only).

The design of a hydro-electric power station is affected by local conditions to a much greater extent than if any other form of motive power were employed. In some favoured cases an actual waterfall has been found ready to hand, but in many cases long lengths of flume, pipe, or tunnel have been necessary, especially in the western and central districts of America.

In some cases the river follows such a winding course that a short tunnel driven through a mountain will tap the stream many miles further along its course.

The flumes are generally built of wood, although the use of reinforced concrete is now being considered, as the life of a wooden one only averages about five years, and the flume requires constant watching and patrolling.

The choice of prime mover adopted depends very much upon the head of water available. Pelton or Doble wheels are generally used on high heads of 500 ft. and over, and reaction turbines on the lower ones. Pelton or Doble wheels are invariably installed with horizontal shafts, but turbines are used with either vertical or horizontal ones, although the vertical-shaft type is the most favoured at the present time.

Great care must be taken to protect the pipe-line from the effects of water hammer or stress due to the load being suddenly thrown off. There have been cases of stations having their pipe-lines completely wrecked by the sudden closing of a valve at the lower end. The chief function of the governor in a hydraulic station as generally installed in the western and central States is to prevent the machines from running away if the whole load is suddenly thrown off. During normal operation it is common practice to keep the machines running at full load and look after the variations by means of a steam plant installed at some other point on the system.

If governing is done by checking the flow of water, it is necessary to have some form of relief valve or surge pipe installed.

With high-head plants using Pelton or Doble wheels, governing is almost invariably obtained by swinging the nozzles so as to partially clear the buckets.

So difficult is the problem of satisfactory governing that on some of the older plants arrangements are installed for putting on artificial load in order to keep the total draught on the station steady. In the case of Pelton wheels driving exciters and fed off the main pipe-line, spear-rod governing is employed, as the quantity of water used is only small. In a small (300-kw.) station at Cornell University, the water was allowed to compress a column of air in a steel cylinder, which thus acted as a buffer.

General practice in the most recent stations appears to favour generation at about 11,000 volts, with oil-insulated water-cooled transformers of large capacity raising the pressure to that of the line. Taps are frequently provided for working at less than the full voltage, if desired, and this is often done during the early stages of the plant, before it gets its full load. In some cases the transformer is considered as forming one unit with its generating plant. In one case the transformers were treated as forming part of the line, a bank of three single-phase transformers being connected thereto without any high-tension switchgear at all; this, however, is not usually the case.

In only one case were direct-coupled exciters found. Separate machines driven by small turbines or Pelton wheels are practically universal.

Considerable diversity exists in the design of the switchgear, both cell type and open-pattern arrangement being found.

If the Niagara plants are left out, the majority of the stations visited had their high-tension gear and bus-bars quite exposed, although neighbouring parts were generally separated by brick partitions. Copper or aluminium rods supported on large pin-type insulators were used in all the plants except that of the Central Colorado Co., where the rods were hung from above by means of suspension insulators such as were employed on the line. Just outside the station are placed the lightning arresters. Inside the station the line goes to a choking coil, usually a plain copper spiral hung in the air. In all cases but one the line was fed through oil and disconnecting switches from the high-tension "bus." The disconnecting switches are usually plain knife switches, opened by hand by means of a wooden rod about 8 ft long. The insulation of this rod is quite sufficient to allow the user to touch live parts with perfect safety.

Instrument transformers are frequently employed on the high-tension side of the station, although they tend to assume rather formidable proportions. Small electrostatic potential indicators are used on the high-tension conductors to indicate to the operators whether these are alive or not. They consist simply of a pivoted

aluminium vane moving in front of a fixed sector, and acting on a similar principle to an ordinary electroscope.

The generators employed in modern stations are all revolving-pole machines of fairly high speed, a 10,000-KW. machine generally running at about 300 R.P.M. Salient-pole rotors and natural ventilation seem to be universal. Both three-phase transformers and banks of single-phase units are employed, and practice does not seem to be decided as to which of these is the best.

Air-cooled and insulated transformers are used in some of the older stations working at 40,000 volts and under, but not in any of the newer or very high-voltage plants. The fire risk from oil insulation does not appear to be great, although it is usual to place each transformer in a separate brick chamber with a steel door that can be closed if required.

The insulation of the high-tension leads where they pass through the case of the transformer is a most difficult problem. A terminal for 100,000 volts is quite a large thing, even if condenser type insulation be adopted. The object of the so-called condenser-type insulation is to obtain a terminal over the surface of the insulation of which the potential gradient shall be as nearly as possible uniform. This is done by embedding in the insulating material metal laminæ whose dimensions are so chosen that the capacity between any two laminæ is the same, this giving a number of equal increments of potential from the case of the transformer to the live conductor.

With the exception of a 33,000-volt line feeding Schenectady, all plants in the State working at less than 65,000 volts appear to use pin insulators, while above this the suspension type is employed.

Brown porcelain is very general, but a slate-coloured glaze is now being introduced, which is said to give a very inconspicuous insulator. Glass insulators are not used on the highest voltage lines. Lack of mechanical strength and liability to cracking by the action of frost seem to be their chief disadvantages.

Suspension insulators and steel towers are the latest development in line construction, and are always used for the very high voltages—*i.e.*, 100,000 volts or so. There are two types of suspension insulators in common use, viz, the Locke and the General Electric patterns (figs. 2 and 3). These are generally used either four or five

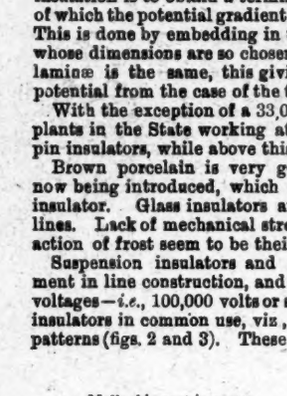


FIG. 2.—LOCKE PATTERN SUSPENSION-INSULATOR.

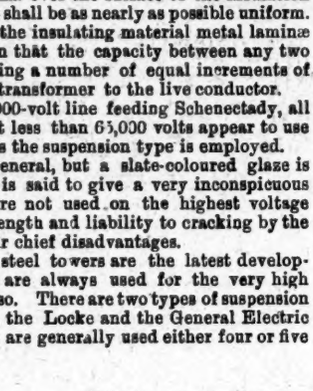


FIG. 3.—GENERAL ELECTRIC SUSPENSION INSULATOR.

in series on a 100,000-volt line, which gives ample insulation even if one insulator should break down. They are hung from the cross-arms. Generally if only one line is installed, the three conductors are placed in one horizontal plane. When two lines are run, three conductors can be placed on each side of the tower and suspended from three cross-arms.

The towers are generally galvanised steel, shipped in sections which are bolted together at the site. Each section is galvanised completely after construction, so that the risk of corrosion is very slight. It is usual to test insulators to at least 50 per cent. above their working pressure before leaving the works.

Salt sea fogs and dust storms deposit salt on the insulators, and cause short circuits. Heavy rains do little harm, and keep the insulators clean. Snow and sleet occasionally cause trouble. Instances occur every winter of eastern districts being shut down for periods which would be thought excessive in England. Wooden pins are being steadily displaced by iron pins, which are now universally employed in new installations.

With a wooden pole-line the length of span is usually from 120 to 150 ft., but with a steel tower construction it is no unusual thing to have as long a span as 1,200 ft. for the normal line. Where a canyon or strait has to be crossed spans as long as 3,000 ft. are installed, but in this case steel wire is used instead of aluminium or copper. The wires oscillate very little when they are deflected by the wind, and swing in unison. The normal clearance on a 60,000-volt line is 6 ft., on a 100,000-volt line 10 ft. The sag allowed may be very large, as much as 30 or 40 ft., at the highest temperatures.

Where the transmission line crosses a railroad or road, the usual practice is to arrange two towers as near together as possible on each side, so that a wire breaking will not be able to reach the ground. A cage such as is common in England is rarely, if ever, seen, and in some parts no special precaution is taken against risk from falling wires.

The two metals chiefly used for an overhead line are aluminium and copper. The tendency in the newer stations on the Pacific Coast is to use copper. The conductor used is, in nearly every case, a stranded one. Even when stranded with seven or 19 wires the cable is often too stiff for convenient handling, and a hemp core is inserted; by having the conductors regularly arranged around a central core the stress is more uniformly distributed, and the cable has greater strength for a given cross-section of material than if it were built up in the ordinary way.

Steel, in spite of its relatively high resistance, is used on all very long spans of 3,000 ft. or over.

SUB-STATIONS.

Direct-current distribution is unknown except in one or two of the largest towns, and then only in the central districts. The universal system of distribution is by means of overhead wires strung on wooden poles and working at 2,300 volts; these are carried along all the streets. At intervals a small transformer is bolted on the pole, and steps the pressure down to 110 volts for service to the neighbouring houses. In consequence of this there is a large number of sub-stations which simply contain static transformers for reducing the pressure to the 2,300 volts required for distribution, and induction regulators for regulating the voltage on the outgoing side. In some of the sub-stations of the Pacific Gas and Electric Co., regulation was obtained by the use of tapping points on the transformers.

In some towns the 60,000-volt current is stepped down to 12,000 volts or so before entering the city.

Underground cables are used occasionally in the busier districts of the large cities, but are, generally speaking, very uncommon.

Sub-stations converting from alternating to direct current are chiefly used for railway work, but also for city supply and series-arc lighting. The machinery installed presents no special interest. Rotary converters are used on 60 cycles up to quite large sizes.

Vertical shaft machines are found in some stations, an interesting example being some rotary converters now being built in which the shaft is stationary and the armature spins on it as a pivot.

Stations supplying current for series-arc lighting are peculiar to the American Continent, quite high voltages (up to 10,000 volts) being employed. Rotating machinery is sometimes employed to effect the conversion, but extensive use is also made of mercury vapour rectifiers combined with constant-current transformers. These rectifiers appear to be very successful, having a life of 3,000-4,000 hours and being built up to a capacity of 10,000 volts and 30 amperes.

Batteries do not appear to be much used except in some of the larger towns.

It is very rarely that separate generating plants are provided for traction and lighting service. One company usually operates the whole, from one system, and this, combined with the large use of power for heating, power and elevator service, probably tends to the realisation of a better load factor than obtains on the average English station.

When low-frequency current has to be distributed for lighting purposes it is the usual practice to install frequency-changing plant. It is remarkable that very little lighting has been attempted at the lower frequencies. With incandescent lamps, either of the carbon or Nernst pattern, the flicker when the lamps are supplied with current at 25 cycles is imperceptible, and even with metal-filament lamps this effect is hardly noticeable. The only lamps with which such a low frequency becomes a matter of importance are arcs; but as, on an alternating current, all arc lamps are notably inefficient as compared with direct-current ones, it hardly seems worth while changing frequency in order to make alternating lamps effective. In some places sub-stations containing machinery of 35,000-40,000 KW. have been installed to change the frequency of supply from 30 to 60, and to an impartial observer it would seem a far better plan to have spent the money so invested in improving the distributing system.

DISCUSSION.

MR. T. L. MILLER said that, where it was possible to use the deflecting type of nozzle for water turbine governing, that was probably the safest method. In a number of cases it was arranged for the governor to open a by-pass on the load being thrown off, allowing the surplus water to get away. Relief valves should be fitted on the main pipe line, as, in the event of the governor sticking, serious trouble was sure to occur to the pipe line. The surge pipe only protected the tunnel and not the lower length of pipe. Regarding poles, the latest practice was to use concrete poles; they were lighter than iron, and were not subject to the same amount of depreciation as wood or iron poles. They were also of considerable value where insects attacked wooden poles. On a job in India, he had obtained prices for towers for the following spans:—

Length of span, in feet ...	300	400	900
Price	£14 5s.	£47 10s.	£109 10s.

MR. J. S. PECK said that one reason that had developed long-distance transmission in America was that it was easy to obtain wayleaves, and there were no Board of Trade regulations. He did not see that the pneumatic switch should be any more rapid in action than the electromagnetic switch. Transposing the circuits should eliminate troubles on telephone lines, if they were transposed at the proper points, so that the voltage generated at one part of the line was neutralised at another. At Niagara they had experienced a great amount of trouble with ice and snow. He had seen about 100 men engaged at one time pulling up the ice, blasting with dynamite, and doing everything possible to keep the ice clear. Many different devices were employed, and there was very little trouble now.

MR. S. L. PEARCE said that the capital costs of these water-power schemes should not be lost sight of. In connection with the station at Niagara, the cost was given at from £20 to £30 per KW., including the transmission line; comparing these with a modern steam turbine station, and including £10 per KW. for distribution, it appeared that the steam station would still have some substantial advantage, remembering what an important bearing the question of capital costs had on the supply rates. As far as he knew, the average rates for power supply in the States were in excess of those in this country. The question of way-leaves was

an important one. Some two or three years ago, he considered the advisability of supplying some of the outlying districts of Manchester by means of an overhead transmission line, and found that at the best something like 20 per cent. only could be saved as compared with an underground system. Moreover, certain restrictions were laid down, certain roads would not be allowed to be crossed overhead, and by the time all these difficulties had been met there was practically no saving to be effected. He believed 25 periods was being used for lighting successfully in this country at the present time. The advantages lay with delta connections for power work; the main point was one of the reliability of supply. If the consumer wanted lighting as well there was an arrangement (which he thought was due to Mr. Peck) viz., the introduction of interconnected star balancing coils giving the neutral point for lighting purposes.

Prof. Schwartz said he had made some experiments, and found that if steam was discharged through a pipe on to a wire carrying a pressure of 100,000 volts, the steam was deflected very strongly away from the wire. He had made experiments on specimen test pieces of vitreous h.t. porcelain, and found that in tension the strength of a rectangular test piece ranged from 3,136 lb. per sq. in. with a section of 0·2 sq. in. down to 2,000 lb. per sq. in., with a cross-sectional area of about 0·6 sq. in. The reason that the tensile strength diminished with the larger size test piece appeared to be the fact that in firing the porcelain the action of the heat had not been so great at the centre of the cylinder as it was on the outside, and consequently with the large test piece, the porcelain was not so vitreous throughout as in the case of the smaller test pieces. He found the same effect with cylinders tested in compression. With cylinders 2 in. long and 2 in. diameter, the breaking load was about 10,000 lb., for 1 in. it rose to 40,000 lb., and for $\frac{1}{8}$ in. diameter it rose to 52,000 lb. Considering that such a great difference existed between the strengths of porcelain in tension and compression, they ought to design insulators so that the porcelain was in compression at the point of support. Fig. 2 showed the Locke pattern suspension insulator with the porcelain in tension, whereas fig. 3 gave the G.E. suspension insulator with the porcelain in compression. In the latter type of insulator the support was formed by two wire cables interlinked with one another, with the porcelain between them in compression.

Mr. Miles Walker said he was sure that within the next ten years overhead transmission would come. Considering the question of transmission to London from the coalfields 100 miles north of London, if a large aluminium wire were used, say 1 in. diameter, at a pressure of 100,000 volts and a triple line consisting of 9 wires 1 in. diameter by 100 miles long, the total weight of aluminium worked out at about 2,000 tons. Supposing the cost to be £300 per mile, they would have a total cost of £440,000. Taking interest and depreciation at 10 per cent. they got £44,000. Considering the cost of transmission of electricity as compared with that of the transmission of coal from the coalfields of England by land or water, the efficiency of transmission was a great deal less than 50 per cent. The cost of coal in London per kw.-hour generated had never been reduced below 0·2d.; with large steam turbines the cost of coal could be got down to 0·1d. Taking it at 0·1d. at the pit mouth and 0·2d. in London, they had 0·1d. to play with, and with 10,000 kw. [? 100,000.—Eds.], taking the load factor at 0·3, this worked out to a total of £120,000 per year as the saving in coal.

Mr. Chamen said that overhead lines at 10,000 or 20,000 volts worked very satisfactorily, and he thought that no mains men who had worked both overhead and underground systems would disagree with him when he said it was not the overhead system which gave them the greatest trouble or that cost them the most money in maintenance. An overhead line was very easily repaired if trouble occurred. He had known 10,000-volt lines, without any protection whatever except spark gaps and carbon rod protection devices, to live through the worst thunderstorms which he had experienced in this country, and which did damage in the vicinity of the lines. He felt assured that in adding lightning arresters, one was only asking for trouble. As regarded the earth wire being run over the top of the h.t. lines, this was the very reverse of a lightning arrester, but even in the use of this it appeared to him that trouble was more or less asked for as lightning would use this path, and even if it found this path of sufficient capacity, might still induce a high potential to earth on the line itself in so doing.

Mr. A. B. Mallinson said one of the weakest points of an overhead transmission line, as at present installed in this country, was due to the guard nets required when crossing the public roads, &c. He gathered that in American practice, they rarely, if ever, used them. If the line was well designed and carefully erected, there was little or no reason why breakages should occur, but the addition of a number of guard nets must sooner or later cause interruptions of supply from short circuits caused by broken wires.

Mr A. P. M. Fleming said with reference to the choice between star and delta connections, a point had been raised in the discussion in regard to the use of an interconnected star balancer on delta lighting systems, where it was desirable to obtain a neutral point for lighting voltages. He pointed out a further use of this apparatus and its influence on the choice of star or delta connections for step-down transformers supplying mixed power and lighting loads. A three-phase transformer combination was cheapest and most efficient when connected in star on both h.t. and l.t. sides, but for balanced lighting on the low-tension between outers and neutral, it was necessary to bring the neutral back from the lighting distribution to the star point of the transformer, and also to connect the neutral point of the h.t. side to that at the generator end, in order to avoid unbalanced ampere-turns on the different phases of the transformer and consequent unbalancing of voltage. When the interconnected star balancer was used, the neutral connection on the h.t. side was unnecessary, and it could also be dispensed with on the l.t. side between the main transformer and the balancer. A similar economy as regarded cost and efficiency of main transformer was obtained when the latter was connected in star on the h.t. and delta on the l.t. side, and in this case the balancer provided the neutral point for the lighting voltage. With regard to line construction, the voltages employed in this country had not been high enough to demand serious consideration of the relative merits of the pin-supported and the suspension types of insulator. The authors stated that the prevailing practice in America was the use of the pin-supported insulator for voltages up to about 60,000, and he would like to have their opinion as to whether the suspension type could not be economically employed for much lower voltages. From an electrical point of view, the maximum voltage for which the pin type of insulator was suitable was limited by the intensity of stress in the comparatively small thickness of porcelain between line and ground, *i.e.*, pin head, since for voltages of the order of 60,000 a metal pin was necessary. The thickness of material above the pin head could be made ample for low voltages, but could not be safely increased in proportion to the voltage, as the stability of the support was weakened and difficulties were met with in the manufacture of the porcelain. This steep potential gradient between line and pin head, in addition to stressing the material at its thinnest section, tended to produce a discharge over the outer surface of the insulator, which might cause a flash-over from line to pin and also tended to produce heating around the pinhead, unless the fit in the porcelain was very good. The contour of the petticoats of the insulator could be so designed as to reduce the tendency to flash over to a minimum, but the insulator became a complicated affair, and required to be built up in several parts cemented together, and a material having a very doubtful insulation value at high voltages at the point where the stress was greatest, was introduced. In the case of the suspension type of insulator, the entire stress between line and ground was more or less equally divided over a number of separate units, ample surface insulation could be provided without undue increase in weight or complexity of design, and if one unit was mechanically damaged, the insulation value of the entire insulator was not destroyed, also a great factor of safety could be obtained without much increase in cost.

Dr. E. Rosenberg said the advantages of the asynchronous type of generator was very often over-estimated. It was assumed that the induction generator could be thrown straight on to the line without synchronising. This might be right for very small machines, but with machines of any appreciable output, great precautions must be taken in order to avoid the dangerous rushes of current which otherwise would occur. This was true of induction generators of a few hundred horse-power. Readers who would refer to Mr. Rider's paper on the L.C.C. tramway system would find that in the case of 500-kw. motor-generators, the machines were brought up to synchronous speed from the d.c. side, and a stroboscopic device was used to ascertain the exact synchronous speed before switching the induction motor on to the line. Even then a rush of current occurred, just the same as when connecting a transformer suddenly to full voltage, and in order to reduce heavy rushes, choking coils were temporarily inserted.

The chairman, Mr. S. J. Watson, said that in Lancashire towns the power consumption in individual centres run from about $\frac{1}{2}$ to 1 h.p. per inhabitant, and in Manchester alone there was half a million to a million horse-power in use. He did not think that power to this amount was going to be produced in the colliery district, as the capital cost of transmitting it was so great.

Mr. F. V. T. Lee (Pacific Gas and Electric Co., San Francisco) in a communication to Dr. E. W. Marchant, said that they had a large number of asynchronous generators on their system, and used them in all their large power houses; they were not used for their value as energy producers, but merely for the purpose of taking advantage of their characteristics for the purpose of governing the exciter water-wheels. The history of the introduction of these units had never been definitely published. About 1898 or 1899, in the installation of hydro-electric plants, a great deal of difficulty was experienced in obtaining a satisfactory water-wheel governor for the purpose of obtaining regulation to admit of parallel operation. The exciter sets were then, as now, almost entirely water-wheel driven, being the successors to the belted exciter with its inherent difficulties. With the water-wheel driven exciter the cost of a good governor seemed prohibitive, and the ordinary induction motor-driven exciter, due to poor speed regulation of the induction motors then commercially obtainable, was almost, if not quite, as bad as the belted unit. Another difficulty that was experienced, in the high-head plants particularly, was that owing to the smallness of the nozzle on the exciter wheel it was very readily choked up by twigs and other small articles, with the result that it was not infrequent that the plants shut down from that cause. In the East, at Niagara, the difficulty of regulation was taken care of by placing an artificial load in the form of a resistance in shunt with the generator fields. The exciter wheel then was run at constant load, which was divided between the resistance and the generator fields, as conditions required. A constant load, however, was kept on the water-wheel at all times. The late Mr. Theodore E. Thebarath and the writer, in order to do away with the induction motor, developed a scheme using a synchronous motor, water-wheel and exciter coupled together on the one shaft, and operating the other water-wheel at full load at all times. The difficulty with this, however, was that if for any reason there was trouble with the water-wheel, the synchronous motor fell out of step, and it would be difficult to start it again. About this time Steinmetz's paper on the induction generator was published, and Theberath immediately recognised that this machine had the characteristics that they were looking for. A set was

installed, and the results obtained were so good that they had been used ever since on this system, and, in fact, the Taeberath exciter set would be found in use on most systems in the West. Anybody who would consider the matter would appreciate that they were ideal and gave a guarantee of operation that could not be obtained otherwise. The writer had expanded this idea in connection with turbine stations, and proposed in their steam turbine station, when it was extended, to put in a small steam turbine direct connected to an exciter, with an induction-motor on the same shaft. This would then operate exactly as did the water-wheel sets, and would eliminate the governor troubles that had been apparent with steam turbines in small sizes due to the smallness and delicacy of the parts involved.

Messrs. Marchant and Watson, in reply (communicated), said the spigot and socket pipe joint was the most common. Very little trouble appeared to have occurred from leaking pipes. At Island Bar the pipe was protected by relief valves, and the surge pipe served to prevent inertia effects due to the large mass of moving water in the tunnel. The air compressor for protecting the pipe line was not at all common; with proper precautions for maintaining air in the cylinder, it would appear to be an excellent protective device. No reinforced concrete poles were seen; the prices given by Mr. Miller for the 900-ft. span tower were much higher than those quoted for these towers where they were used in large quantities. Electrolytic arresters were almost universal, and the common practice was to charge them every other day. Delta connection was more common than star, and was stated to be the most satisfactory. In spite of this, the star would seem to be the best arrangement on general grounds. Breakdowns were usually caused by ice and snow on the transmission line rather than at the power stations. The induction regulators were usually automatically operated by direct-current motors. Transformer tapping regulators were hand operated. Prof. Schwartz's remarks tended to confirm the belief that the dielectric strength of air in bulk was very much lower than 38 kilovolts per centimetre. The figures for "R" given in the paper were derived from experiments made at the University of Liverpool on the brush discharge from a wire in a concentric tube. They were also confirmed by experiments made by Prof. H. J. Ryan at Cornell University. Prof. Schwartz's experiments on the behaviour of steam blown against a high-tension wire appeared to give a striking illustration of the way in which the ions were shot away from the charged wire. These ions would presumably act as nuclei on which the steam would condense, and would thus be rendered visible. Dr. Rosenberg stated that with large asynchronous generators, it was not only necessary to bring them up to speed before switching in, but also to have them in phase. This surely was incorrect, for a squirrel-cage machine could not be said to have any "in-phase" position at all. The surge caused by throwing such a machine unexcited on to the circuit would probably not be any greater than if a transformer of the same size were suddenly switched on. They did not actually see any asynchronous machines acting as generators pure and simple, but saw quite a number of the asynchronous exciter sets mentioned in Mr. Lee's contribution. They also understood that the Interborough Rapid Transit Co., of New York, had installed a 5,000-kw. machine of this type. In considering the relative capital costs, the expenditure on hydraulic works, pipe line, &c., must be set against the cost of boilers. In almost every case the hydraulic work was much more expensive, though, with particularly favourable conditions and large powers, the hydraulic station might be the cheaper of the two. The cost per kw. of the new Winnipeg station would, it was estimated, be very little in excess of the cost of the most modern steam turbine station. For the case quoted in the paper, the length of transmission line was about 50 miles. The cost of electrical energy per B.T.U. was usually higher in America than in England, though the charge for power purposes at Niagara was only £2 per H.P.-year. The climate of San Francisco was very foggy, and some trouble had been caused by damp on the insulators, but the difficulties had not been at all serious. The question of long-distance distribution was largely a matter of wayleaves. The overhead earthed wire not only tended to protect the line from direct lightning stroke, but also screened it from the effects due to electrostatic induction. Lightning seemed to cause much less trouble at 100,000 volts than on transmission lines working at 20,000 or 30,000 volts. There was considerable lack of confidence among station engineers in any form of lightning arrester as a protective against direct lightning stroke. The water-jet arresters, unless the water was not very clean, appeared to give quite ineffective protection against lightning, although in the case of a system running entirely insulated from earth without any grounded point, they might serve to prevent the accumulation of any static charge on the line or apparatus. It was quite likely that it might be found good practice to have suspension type insulators for lower voltages than that for which they had hitherto been employed. Guard nets in America were only employed where a line crossed a very busy road, and were the exception rather than the rule. The requirement of guard nets in this country where a transmission line crossed a little-used footpath in a remote mountain district seemed possibly a little overdone. There were very few cases where the transformers were tied straight through. High tension switching was the rule, and was absolutely necessary where duplicate lines were installed. The 110,000-volt plant of the Ontario Power Co. was not yet installed, although the plans had been prepared. The cost of land for the transmission line was not merely the cost of the patch of land on which the pole stood, but of all the land under the line for such a width as was considered to ensure sufficient protection against falling wires. The chief fuel used on the Pacific Coast, both on the railways and in the power stations, was Californian oil.

Notes on Methods and Practice in the German Electrical Industry.

By L. J. Lepine and A. R. Stelling, Dipl.Ing., Students.

(*Abstract of paper read before the* Institution of Electrical Engineers, *London, December 9th*, 1909.)

In this paper it is proposed to enumerate the salient factors in the cheap methods of production which render the Germans such serious competitors in the world's markets.

Prior to 1899 the industry in Germany was divided up among a great many firms. Even at this early date German financiers seem to have realised the advantages which would accrue from association of interests, and they commenced a policy of amalgamation. With each of the more financially powerful firms was associated a trading or investment company; the majority of the shares in the latter were held by the manufacturing company. With the capital at their disposal the investment companies were enabled to finance supply undertakings, the electrification of tramways, &c., and so obtain markets for the parent manufacturing firm. The remainder of the shares in the investment company were, as a rule, held by syndicates of financiers or by banks. Banks in Germany are of a different constitution to English banks. In the first place, their capital is usually much larger than is customary in England, and a large portion of this capital is always at the disposal of the directors for investment in industrial concerns. There are other so-called banks which are purely trading syndicates, and whose capital, or rather financial power derived from their capital, is solely used for the purpose of financial industrial undertakings.

As regards the electrical industry, the principal sphere of action of both wholly industrial banks and deposit banks having an industrial development department was in connection with supply companies and electric tramways or railways. When such a company was floated, the bank or investment syndicate took up or underwrote a certain number of shares. The necessary capital was obtained by the issue of bonds on the share capital of the bank and on the shares already held in other companies. The manufacturing company also took up a number of shares, shares already held being mortgaged for the purpose of obtaining the ready money. Where advances were made to companies for extensions, these were redeemed later by mortgages on the new plant or by a new issue of capital.

This system, as will be observed, readily lends itself to reckless speculation. During 1899 and 1900 a boom in electrical engineering led to much speculative promotion of electrical schemes and exaggerated extensions of existing ones; the result was an inevitable reaction. Depositors became alarmed at the investments made by their banks, and two banks, the Dresden and Leipzig Credit Banks, had to go into liquidation. It should be noted that both these institutions were deposit banks. The feeling of insecurity which succeeded caused a set-back in all branches of electrical engineering, and we may describe the period from 1901 to the end of 1903 as one of reconstruction and amalgamation. In the first place, several firms had to undergo entire reconstruction, but the investment companies and private financial syndicates enabled other firms to successfully weather the depression. Many of the smaller firms which suffered were absorbed by the larger and more influential ones, and there are emerged from this period the three great German combinations of Allgemeine Elektricitäts Gesellschaft, the Siemens-Schuckert group, and Felten-Guilleaume-Lahmeyer. The amalgamated firms proceeded to strengthen their position and prevent *injurious* competition by completing certain working agreements. At the same time they left certain branches open to competition among themselves, especially those in which they found rivals in the smaller firms, whose interests were purely local.

During the years that followed, the trade in Germany as a whole slowly recovered. The direct result of the amalgamation and working agreements was that these powerful combinations and their associated syndicates were able to control the market, cause a steadying of prices and an ultimate recovery of confidence.

The heavy electrical machinery trade in Germany is now almost entirely in the hands of four large companies—the three already mentioned and the Bergmann Co.; the latter to a certain extent are a party to these working agreements. The capital of these firms stands at the following figures:—

A.E.G. ...	£4,200,000 share. £1,930,000 bond.	F. & G.-Lahmeyer ...	£2,750,000 share. £1,250,000 bond.
Siemens-Schuckert	£4,500,000 share. £990,500 bond.	Bergmann ...	£1,050,000 share. £500,000 bond.

The best proof of their success is to be found in the dividends paid by these firms. We give the dividends for the last two years:—

	1908.	1907.
A.E.G.	12 per cent.	12 per cent.
Siemens-Schuckert	10 „	10 „
F. & G.-Lahmeyer	8 „	10 „
Bergmann	18 „	18 „

One great advantage of their large capital is their ability to meet sudden demands caused by the advancement of engineering science, such as the erection of special plant for the construction of turbo-generators.

As another example may be cited the participation of German firms in the Victoria Falls power scheme. Not only have they contributed a large portion of the necessary capital, but they are

also erecting special shops for the construction of the generating plant, *i.e.*, 20 000 KW. sets.

Turning to the investment companies, many of these became entirely merged in manufacturing concerns, and were thus enabled to substantially reduce their capital; others improved their financial position by disposing of their shares in unremunerative concerns and opening up new fields.

A glance at the latest report of one of these investment companies shows that no supply company in which they are interested pays less that 6 per cent dividend; the investment company themselves pay 10 per cent. dividend on a share capital of £1,600,000.

In the improvement of the trade the material assistance afforded by financial syndicates has been of such value that during 1908 a further step in electrical finance was taken. This was the establishing of two electro-trustee banks (Elektrotreuhandbanken) under the control of the large German electrical companies.

The principal object of these "trustee" banks is to advance to large consumers in the electrical industry the money they may require for beginning and carrying out costly works. The capital needed for the loans is to be obtained by mortgage bonds, secured in the first place by the stocks held by the bank, and in the second place by the share capital of the latter which is to be invested in trustee stocks. As the shares, however, will most probably be retained by the electric works concerned, the entire business resolves itself into a transaction enabling these companies to raise the funds they need in order to assist and open larger credits to their customers, the formation of separate banks evidently having been decided upon as the most likely method of facilitating the placing of bonds. These facilities for obtaining cash advances are to be extended principally to municipalities and other public bodies, so that the bonds will be to all intents perfectly secure, while at the same time these authorities will be encouraged to proceed with any plans for the erection of new or the extension of old electrical plant which they may have under consideration, without the necessity of issuing new loans for that purpose.

The present situation is one which in spite of the general trade depression must be described as satisfactory; electrical undertakings are readily able to find working capital independent of the state of the money market and of the manufacturing industry in general. Looking ahead, developments of a less pleasing nature appear to threaten. The various financial institutions, by providing the manufacturers with working capital and credit, enable them to compete successfully in all markets and render each firm independent of the others where capital is required; but should the activity of the banks be reduced from any cause, or should foreign and local competition become so keen as to cause repeated price-cutting, then the great disadvantages of over-capitalisation will make themselves felt, and the large firms will be driven to the formation of a huge trust with their associated banks as a nucleus, their existing intimate relationship rendering the accomplishment of this all the more easy.

Internal Organisation.

In the offices of the firms in question a bureaucratic rule obtains. The keynote of the whole system is that each man's work is specialised.

Each branch of manufacture is an organisation in itself, having its own drawing office, designing, costing and clerical staff. Alternating-current induction motors, alternating-current generators and synchronous motors, direct-current small and large machines, and turbo-generators are treated in separate departments, as are also alternating-current and direct-current instruments, wattmeters and switchgear. There are separate drawing offices for estimating purposes for transmission schemes, lighting schemes and cental station designs.

A publicity department run by University graduates in literature is responsible for the catalogue and journalistic work. This department is officially termed the "literary" or "propaganda" department.

Besides this department and the estimating offices for the home trade, each firm has a foreign department which deals exclusively with inquiries from abroad, and which is in correspondence with the branch offices (outside Germany) and the subsidiary companies. The value of this department cannot be too highly estimated. All these various departments are subject to the "Verwaltung" or central authority, which also deals directly with the employés.

The average technical employé is more highly theoretically trained than in England. All members of the technical staff go through one of the drawing offices; in fact, it is in these departments where all German engineers start on a level footing, the chances of promotion depending chiefly on the quality of their training. Technical employés are usually bound under a contract which is all in favour of the employer. In this contract the employé agrees to publish no technical matter without the consent of his firm, to give no private tuition on technical subjects, nor to divulge any methods of the firm by whom he is employed. Further, all designs which may be patented are the property of his employer. The draughtsman is usually forbidden to enter the shops.

Salaries are kept low; after leaving college the engineer commencing work at about 24 years of age receives £3 5s. a month. This increases with machine-like regularity until it reaches the maximum wage for the department. Holidays of more than three days either from head office or from a branch office must be granted by the central authority.

External Organisation.

Each firm's trade in Germany is attended to by the head office and branch offices, while to subsidiary companies with their own branch offices is entrusted the control of their trade with other countries.

In dealing with their home trade the German method of working up connections is thorough. Besides obtaining business by the ordinary methods which are employed in England, they spend considerable sums of money in educating the masses. For instance, the following procedure is employed in districts where electricity is an unknown quantity.

Invitations are sent out to the principal householders to attend a lantern-slide lecture on the benefits to be derived from the application of electricity in the home or factory, and the interest of the population is thus aroused. The engineer then approaches the local mayor and other officials and persuades them to apply (either alone or in conjunction with other villages, as the case may be) for the necessary grant and powers to finance and erect the plant required. In this way many overland central stations have been erected in which the manufacturers have a pecuniary interest. Not only do they then supply the power plant, but also the whole of the fittings required by the consumers, and this on a very profitable basis.

With regard to European trade, this is developed chiefly by means of subsidiary companies having share capitals varying from £100,000 to £600,000, according to the country. These companies are all provided with branch offices, which are controlled by the subsidiary company financially, but which deal directly with the factory in technical matters.

Again, complete staffs are maintained in the countries outside Europe where many competitive English firms are content to employ agents; often enough the latter have but the faintest ideas on the subject of electricity and its application. It will be seen from this and the foregoing paragraph that German firms are always in a position to treat inquiries from all countries with the utmost consideration, and to furnish very complete tenders which are sure to meet customers' requirements. They make a point of accurately ascertaining these requirements; to put it figuratively, "if a screw is required, they are not content with being told the size; they want to see the place into which it is to fit."

As the English firms rarely trouble to send experts to investigate proposed schemes, but are content to let branch managers or agents muddle through as best they can, it is not to be wondered at that German firms obtain so many profitable orders in open competition.

The following figures, taken from Board of Trade returns, will perhaps be of interest; they are given for the last few months:—

	Electrical imports to Great Britain from Germany.	Electrical exports to Germany from Great Britain.
May	£72,843	£3,933
June	89 779	4,494
July	91,708	2,137
August	73,331	881
September	82,313	1,841

These figures show a pretty good average of the trade done between England and Germany, as is evident from the following table:—

Electrical Exports of Germany and Great Britain.

—	From Germany.		From Great Britain.	
	To Great Britain.	To other countries.	To Germany.	To other countries.
1907.	£553,882	£7,673 118	£45 533	£3,419 583
1908	712,251	8,394,750	46,873	3,240,249

The sums included in the figures under "Exports to Great Britain" for electrical machinery are, for 1907, £227,991, and 1908, £250,402, these being the largest figures in any one section.

Lamps also account for large amounts, viz, £129,244 and £240,989 respectively, these large figures being accounted for by the advent and popularity of the tantalum lamps.

(To be continued.)

OUR LEGAL QUERY COLUMN.

[Questions addressed to this column should be written on one side of the paper only.]

"Electrical Engineer" writes:—"Under the Electric Lighting Act, 1882, a local authority may make by-laws or wiring rules, but such by-laws cannot be enforced unless they have been confirmed by the Board of Trade.

"What power, therefore, has a council to insist that certain wiring rules, say, the Institution of Electrical Engineers, shall be observed? It is true that under the Model Order, supply may be refused under Sec. 22, which states that the undertakers shall not be compelled to give a supply of energy unless the lines, &c, are in good order and condition, and not calculated to affect injuriously the use of energy supplied by the undertakers by other persons.

"There is a great difference between our right of refusal under this Clause, and our right to refuse supply because the consumer has not observed a reasonable wiring rule. (The actual offence

is that he has carried out extension wiring work himself, without notice or application or testing, has connected up same to existing installation, and his method of wiring is in defiance of ours and I.E.E. rules.) But if we have no such right, how are we to keep up a good standard of work?

"So far as my experience goes, I have not found it to be the practice to submit the local wiring rules and regulations for the Board of Trade's approval. Is it asking too much of you to deal with this in your 'Legal Query Column,' without any names being mentioned?"

*** The above query appears to be met by Sec. 6 of the Electric Lighting Act, 1882, which provides that a local authority may, in addition to the regulations which may be made under the preceding provisions of this section for securing the safety of the public, from time to time make, rescind, alter or repeal by-laws for further securing such safety; and there may be annexed to any breach of such by-laws such penalties to be recovered in a summary manner as they may think necessary; provided always that no such by-laws shall have any force or effect unless and until they have been confirmed by the Board of Trade, and published in such manner as the Board of Trade may direct. No by-laws under this clause had (up to 1903) been submitted to or approved by the Board of Trade—and the by-laws of local authorities have seldom been approved. There appears to be no reason, however, why a local authority could not adopt the I.E.E. rules and impose penalties for their infringement, but no penalties could be enforced unless the rules were approved by the Board.

"W. G. T." writes:—"I shall be much obliged if you can inform me at an early date through your Legal Column, what liability an electric lighting company, working with a provisional order, is under to supply electrical energy in the event of a failure of supply through a prolonged coal strike."

*** The point has not been definitely decided. Undertakers are liable for failure to supply unless it is due to *force majeure* or inevitable accident (Electric Lighting (Clauses) Act, 1899, Sec. 30). A strike is a thing to be provided against by laying in a supply of coal, and if a failure arises owing to lack of coal, it is certainly not *force majeure* (which means an act of God or the King's enemies), nor is it due to inevitable accident.

FOREIGN AND COLONIAL TARIFFS ON ELECTRICAL GOODS.

ITALY.—(*Continued from page 999.*)

	Lire per 100 kg.
Machinery of various kinds actuated by motors and forming a single entity with them (provided that the motor does not predominate in weight in the entire article): Weighing up to 1,000 kg.	19
Weighing more than 1,000 kg.	13
Regulators, switches, resistances, interrupters, commutators, controllers, speed regulators, cut-offs, &c.: Weighing up to 100 kg.	30
Weighing more than 100 kg.	25
Detached parts of dynamo electric machines and of transformers: Of iron or steel and weighing more than 1,000 kg. each	16
Other	25
Cords or cables formed of one or more metallic conductors covered with textile material and varnish, with or without india-rubber or gutta-percha	50
Cables formed of one or more metallic conductors covered with insulating materials, sheathed or protected with iron or any other metal, including submarine cables ...	28
Arc lamps	60
Incandescent electric lamps	5 per 100
Earthenware, common	6
„ fine	18
Porcelain, white	16
India-rubber and gutta-percha, in tubes or sheets combined with wire or metallic gauze	40
Other articles including those of hardened india-rubber (ebonite)	50
Graphite wares	7
Celluloid in plates, sheets, rods, &c., manufactured ...	15
Aluminium and its alloys with copper in wire: More than ½ mm. in diameter	50
½ mm. or less in diameter	75
Nernst electric lamps and parts thereof	60
Burners or radiators for Nernst electric lamps ...	5 per 100
Carbons for electric lamps, with a metallic thread in the interior destined to facilitate the combustion of the carbon	10
Mercury vapour electric lamps	60
Regulators for electric arc lamps	60

(*To be continued.*)

NEW PATENTS APPLIED FOR, 1909.

(NOT YET PUBLISHED.)

Compiled expressly for this journal by MESSRS. W. P. THOMPSON & Co., Electrical Patent Agents, 285, High Holborn, London, W.C., and at Liverpool and Bradford, to whom all inquiries should be addressed.

27,705. "Dental applicator for use with any electric massage vibrator." C. BRICE. November 29th.

27,715. "Improved methods of wireless signalling applicable to telegraphic and telephonic purposes." W. E. HITCH. November 29th.

27,755. "Improvements in electric arc lamps." F. M. LEWIS. November 29th.

27,757. "Improvements in or relating to supports or insulators for carrying electric conductors or cables." B. G. NAVARRO. November 29th.

27,759. "Electric fire alarm." J. CARTER. November 29th.

27,796. "Improved process for insulating contacting electrical conductors from one another." D. TIMAR. November 29th. (Complete.)

27,816. "Improvements in or connected with electric irons and other similarly-heated devices." J. SMITH, H. L. MITCHELL, W. H. ASKHAM and H. HEY. November 29th.

27,827. "Improvements relating to automatic regulators for dynamo-electric machines." BRITISH THOMSON-HOUSTON CO., LTD., and A. P. YOUNG. November 29th.

27,901. "Improvements in apparatus to control the heat of electrically-heated chambers, ovens and the like." J. A. ABBOTT. November 30th.

27,909. "Improvements in provisions for electrically-heating apparatus for incubating, propagating, and cultivating micro-organisms and sterilising." C. E. HEARSON. November 30th. (Complete.)

27,913. "Automatic switch for electric batteries." A. G. BRUTY. November 30th.

27,922. "Improvements in and relating to electric resistances." CLARKE, CHAPMAN & Co., LTD., and R. C. HARRIS. November 30th.

27,925. "Device for ventilating, heating and purifying and creating radio-activity in its operation." C. SCHMIDT. (Date applied for under Sec. 91 of the Act, December 1st, 1908, being date of application in Germany.) November 30th. (Complete.)

27,937. "Improvements in controlling appliances for the electric lighting of vehicles." H. GROB. (Date applied for under Sec. 91 of the Act, January 2nd, 1908, being date of application in Germany. An invention comprised in application No. 28,120, dated December 24th, 1908.) November 30th. (Complete.)

27,973. "Improvements relating to electric furnaces." J. A. DAY. (Date applied for under Sec. 91 of the Act, June 19th, 1909, being date of application in United States.) November 30th. (Complete.)

28,022. "Appliance to attach to motor-cars, electrically-propelled vehicles and the like, to give audible indication of excessive speed." H. G. W. BRINSLEY. December 1st.

28,024. "Improvements in and relating to overhead electric traction conductors for electric railways." SIEMENS BROS. DYNAMO WORKS, LTD. (Siemens Schuckertwerke G.m.b.H., Germany.) December 1st. (Complete.)

28,105. "Improvements in and connected with switches for electric circuits." H. W. HANDCOCK and A. H. DYKES. December 2nd.

28,143. "Improvements relating to the insulating of electrical conductors." SIEMENS BROS. & Co., LTD., and C. R. RIBER. December 2nd. (Complete.)

28,053. "Improved device for controlling an auxiliary electric circuit requiring a voltage which is lower than that of the source of electrical supply." H. W. HILL and W. G. HARDING. December 1st.

28,169. "Improvements in electric telegraphic signalling installations." SIEMENS & HALSKE AKT-GES. (Date applied for under Sec. 91 of the Act, December 3rd, 1908, being date of application in Germany.) December 2nd. (Complete.)

28,184. "Improvements in and relating to electric switches." STERLING TELEPHONE AND ELECTRIC CO., LTD. (Telephon Fabrik Akt-Ges. vorm J. Berliner, Germany.) December 2nd. (Complete.)

28,210. "Electric variator for advertising purposes." A. W. LEONARD. December 3rd.

28,333. "Improvements in electric ceiling fans." W. HUNT (P. S. Swan, India). December 4th.

28,340. "Improved commutator grinder for dynamos and motors." L. NEWITT. December 4th.

PUBLISHED SPECIFICATIONS.

Copies of any of the Specifications in the following list may be obtained of MESSRS. W. P. THOMPSON & Co., 285, High Holborn, W.C., and at Liverpool and Bradford; price, post free, 9d. (in stamps).

1908.

MEANS FOR ELECTRICALLY OPERATING POINTS, SWITCHES, AND THE LIKE ON ELECTRIC TRAMWAYS. R. Hacking and H. W. Hill. 12,614. August 15th. (Post dated August 15th, 1908.)

CONTROL OF ALTERNATING ELECTRIC CURRENT MOTORS OF THE COMMUTATOR TYPE. British Thomson-Houston Co. (General Electric Co.) 19,299. September 14th.

APPARATUS FOR ELECTRIC SIGNALLING IN CONNECTION WITH MINE HAULAGE AND WINDING OR OPERATIONS OF A SIMILAR NATURE. R. Rutherford. 21,693. October 14th.

ELECTRICAL WIRING FOR HOUSES AND THE LIKE. J. S. Highfield. 24,533. November 14th. (Cognate application 27,145 of 1908).

MEANS FOR REGULATING POLYPHASE ELECTRIC COMMUTATOR MACHINES. Allmanna Svenska Elektriska Aktiebolaget & La Cour. 24,581. November 14th. (Date applied for under International Convention, November 14th, 1907).

DYNAMO-ELECTRIC MACHINES. British Thomson-Houston Co. and F. P. Whitaker. 24,854. November 18th.

COMBINED TELEPHONE AND ELECTRIC LIGHT OR OTHER EQUIPMENT FOR USE IN CONNECTION WITH DIVING APPARATUS. R. H. Davis, E. A. Graham and A. W. Cox. 26,837. December 10th.

ELECTRIC IGNITION DEVICES FOR INTERNAL COMBUSTION ENGINES. C. Cecil and H. P. Drondson. 27,212. December 15th.

MEANS FOR ATTACHING SHADES AND REFLECTORS TO INCANDESCENT ELECTRIC LAMPS. C. W. Dawson. 27,669. December 19th.

1909.

AUTOMATIC REGULATING DEVICES FOR SYSTEMS OF ELECTRICAL DISTRIBUTION. British Thomson-Houston Co. (General Electric Co.) 345. January 6th.

ELECTRIC HAND LAMPS. H. J. Fuller. 803. January 13th.

RAIL-SANDING APPARATUS TO BE FIXED TO ELECTRIC OR OTHER TRAMCARS AND THE LIKE. R. Carrick and C. Procter. 1,305. January 19th.